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A BREATHING SPELL.

Full fifty years of seasons fleet
Give pause to round another bend,
A rallying-place for friends to greet
Ere onward once again we wend.

* * * * *

I.

A gallant flood of noble sweep
Our stream holds bravely on its course,
With sparkling face and limpid deep
That draw from rills beside the source.

A varied scene its banks display
In wood and swamp and far ravine;
By mill and farm it makes its way,
By garden-plot and pasture green.

All honour then to those before
Who pointed first the distant goal;
From hill to vale who steadfast bore
To trace the course our waters roll.

With outlook wide, from upland slope,
Our fathers viewed all Nature's ground;
We strive within a smaller scope
To perfect out our little round.

II.

Children at play upon the shore
Of a mysterious, murmuring sea—
But gathered shells is all our lore,
The vaunt of poor humanity.

'Mid doubt and error on we go,
By glimmering star a path we steer;
To seek the truth but not to know,
The lot of all who voyage here.

We have our moments rich and rare;
Amid long hours of darkest night,
When on our vision bursts the glare
Of meteor's trail or Northern Light;

Till comes with dawn the lookout's call,
Strange ships beat up by wind and lee,
In one great quest adventurers all
We sail no more a lonely sea.

III.

Within the heart's all-cherished shrine
Of talents manifold are three
That Nature's mysteries best divine—
Love, Reverence, and Humility.

In earnest work, in eager play,
By Nature-love united all,
With might and main do what we may,
Nor boast the great, nor scorn the small.

"So much to do, so little done"
Each lonely labourer's parting sigh,
Then speed the work so well begun,
The common purpose cannot die.

Each has his place within the plan,
His proper place none else may fill;
In brotherhood our course began,
By brotherhood is furthered still.

* * * * *

Then onward once again we wend
From rallying-place for friends to greet,
From pause to round another bend
And fifty years of seasons fleet.

FRANK MORRIS

Peterborough, Dec., 1918.

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OUR NEW VOLUME.

With the completion of the fiftieth volume of *The Canadian Entomologist*, a convenient opportunity arises for the introduction of any new features or changes that may seem desirable.

For fifty years the size of our page has never varied, a fact which says much for its suitability; but the time has now come when a larger page presents certain advantages, particularly with regard to illustrations. It was accordingly decided at the recent Annual Meeting of our Society to adopt the present size, which is uniform with that of our Annual Report and the Ontario Government bulletins, and is more suitable for full-page illustrations, besides permitting a freer interchange of these with other publications.

This will bring about a considerable reduction in the number of pages, but there will be no material change in the quantity of matter in the text.

The June and July numbers will be issued together and likewise the August and September numbers, so that there will be only ten issues, instead of twelve, two of these being of double size.

POPULAR AND PRACTICAL ENTOMOLOGY.

The Apple Maggot in British Columbia.*

BY W. DOWNES, ENTOMOLOGICAL BRANCH, DOMINION DEPT. AGRICULTURE.

In August, 1917, while collecting insects at Royal Oak, about four miles north of Victoria, B.C., the writer took two specimens of a Trypetid closely resembling the Apple Maggot fly. These were submitted for identification to Dr. J. M. Aldrich, who found them identical with *Rhagoletis pomonella*. Previous to this there have been only two authentic records of its capture on the Pacific slope. In 1894, five specimens were taken by Mr. O. T. Baron in the southern part of California and were described by Snow (1) as *Rhagoletis zephyria*, n. sp. Later this was shown by R. W. Doane (2) and J. M. Aldrich (3) to be a synonym of *R. pomonella*. No further mention of the existence of this species on the Pacific Slope appears to have been made until 1916, when two specimens of the fly were taken on July 26th of that year by Mr. R. C. Treherne (4) at Penticton, B.C.

There is one other record of the fly on the West Coast, but this does not appear to be quite authentic. In 1911, A. L. Melander (5) reported *R. pomonella* as "destructive along the eastern border of the State," but adds that there is no positive evidence of its occurrence in Washington. It is probable in this case that it has been confused with some other insect and, as will be shown later, notwithstanding its occurrence and comparative abundance, the probabilities are against its being a pest of the apple.

The identity of the species being established, a search was at once made for the host plant. This was found without difficulty. Larvæ resembling the species in question were found infesting the snowberry (*Symphoricarpus racemosus* Michx) and 50 pupæ were obtained and kept over the winter. In the spring of 1918, 42 of these were recovered and on August 19th five flies emerged, which were submitted to Dr. Aldrich and were found by him to be identical in all respects with those taken the previous year. It was found that owing to a

*Contributions from the Entomological Branch, Department of Agriculture, Ottawa.

January, 1919

defective cover on the breeding box, eight flies had emerged previous to this date and had escaped. Altogether 18 flies emerged from the 42 pupæ, up to July 22nd, leaving a balance of 24 to be accounted for. Exactly one month later, hymenopterous parasites commenced to emerge from these remaining pupæ, and during the last week of August 16 appeared. Of the remaining eight pupæ probably some are dead, but possibly a few may carry over until the following summer. Through the courtesy of Dr. L. O. Howard, to whom specimens were sent, this parasite was referred to Mr. A. B. Gahan of the U. S. Bureau of Entomology, who reports that it is a new species of Opius (Vipionidæ) and will be described by him at a later date.

The adult fly has been taken by the writer in the city of Victoria and all over the Saanich Peninsula wherever its host plant, the Snowberry, grows, the earliest date of capture being July 11th, and the larvæ have been found in the berries at various points on the Mainland, including Agassiz, Lillooet, Lytton, Chase, Armstrong, Vernon, Penticton, Creston and Nelson.

The Snowberry is a very common shrub all over the drier parts of the Coast and interior of British Columbia. The clusters of pure white berries are very conspicuous along the country roads in the early fall, but among them will be seen numbers that are brown, and shrunken. These are berries that have been eaten out by the maggot, the proportion of infested berries on a bush often running as high as fifty per cent. As a rule, only one maggot is found in a berry, but occasionally a fly will deposit an egg in a berry that already contains a maggot, as berries have been found containing two larvæ, in widely different stages of growth, If the berry should be a small one and happen to be touching another as is frequently the case, the maggot will leave the small berry when it has eaten out the pulp and enter the adjoining one and complete its growth there. The *Symphoricarpus* berries that are attacked by the fly do not drop to the ground, and the maggots remain in the fruit until the last vestige of pulp has been eaten. Later they bore through the now shrunken and discoloured skin and pupate among the dead leaves and humus below the bushes. In its selection of bushes on which to oviposit the fly shows a decided preference for those growing on high and dry spots, stunted bushes growing on hillsides generally having the heaviest infestation. The species is evidently very abundant and widely distributed, but it is seldom indeed that the adults are seen, the experience of the writer being identical in this respect with that of Mr. William C. Woods (6) with regard to the variety prevalent in blueberries in Maine. Although collecting was carried on very frequently through the summer, less than half a dozen adult flies were taken by the writer in 1918. The explanation of this probably lies in the fact that the flies are exceedingly active and shy, and the advent of a collector with a sweeping net is sufficient to scare most of them away from his vicinity. The only times the writer has had the opportunity of watching the flies at close range have been when they have alighted on the leaves of the Burdock (*Arctium minus*). They have been seen to alight on the broad leaves of this plant and walk about, applying the labella here and there to the leaf surface. They do not stay long, however, and at the least movement on the part of the observer they make off.

In commenting on this species, Dr. Aldrich, to whom I am indebted for the identification of the flies and notes on its distribution, says: "They are slightly

smaller in size than those bred from apples and haws, but I can see nothing upon which to base even a varietal distinction." Thus it is evidently an example of a "biological race," similar to, and perhaps identical with, the apple maggot of the blueberry. The fact of the insect being so abundant in this province, coupled with its heavy parasitization by a new species, suggests interesting possibilities.

As regards any other food plant, diligent search has so far failed to reveal any other host of the fly in the neighbourhood of Victoria, though likely species such as *Cratægus* and wild crab have been thoroughly examined, both during 1917 and 1918. The comparatively large size and soft, pulpy nature of the *Symphoricarpus* berries are, no doubt, the reason for its selection. Certain species of *Vaccinium* are found in the province, but they are nowhere abundant, and have not been met with by the writer in the territory in which observations on the fly have been carried on.

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ENTOMOLOGICAL SOCIETY OF ONTARIO—ANNUAL MEETING.

The fifty-fifth Annual Meeting of the Entomological Society of Ontario was held at the Ontario Agricultural College, Guelph, on Wednesday and Thursday, December 4th and 5th, 1918. The President of the Society, Professor L. Caesar, O.A.C., occupied the chair. The following were present at the meeting: Mr. J. J. Davis, West Lafayette, Ind.; Prof. P. J. Parrott, Geneva, N.Y.; Prof. R. Matheson, Ithaca, N.Y.; Dr. C. Gordon Hewitt; Messrs. Arthur Gibson, C. E. Petch, C. B. Hutchings, F. W. L. Sladen and Dr. S. Hadwen, Ottawa; Prof. E. M. Walker, Toronto; Mr. James Dunlop, Woodstock; Mr. W. A. Ross, Vineland; Mr. W. E. Biggar, Hamilton; Mr. F. J. A. Morris, Peterborough; Mr. W. A. Clemens, Toronto; Mr. H. F. Hudson, Strathroy; Father Leopold, La Trappe, P.Q.; Prof. W. Lochhead, Macdonald College, P.Q.; Mr. F. Letourneau, Oka, P.Q.; Prof. W. H. Brittain, Truro, N.S.; Mr. John D. Tothill, Fredericton, N.B.; Mr. Norman Criddle, Treesbank, Man.; Professors C. J. S. Bethune, L. Caesar, J. E. Howitt and D. H. Jones; Dr. R. E. Stone; Messrs. A. W. Baker, H. G. Crawford, Eric Hearle, R. M. Aiton, H. C. Huckett and others, Ontario Agricultural College.

By the kindness of Dr. Creelman the visitors were entertained in the College residence during their stay in Guelph. This arrangement added much to their pleasure by affording many opportunities for social converse, and also saved the time usually spent in travelling to and from the town. This hospitality was greatly appreciated by all present and a hearty vote of thanks was accorded at the close of the meeting to President Creelman, and to the Matron and Superintendent of the Dining Hall.

On Wednesday morning a meeting of the Council was held at which the

report of the proceedings during the past year was drawn up, and various matters relating to the welfare of the Society were discussed. It was decided to enlarge the pages of the "Canadian Entomologist" in order to be uniform with the standard size of bulletins, and to publish ten instead of twelve numbers per annum, omitting the issues of the two mid-summer months, and at the same time the amount of reading matter is not to be reduced.

In the afternoon the members met in the Entomological Lecture-room in the Biological Building, and the proceedings commenced with the presentation of the reports of the Council and the various officers and branches of the Society, followed by the reading of papers, a list of which is given below.

The open meeting was held on Wednesday evening in the auditorium of the Massey Hall, and was opened by a cheery address of welcome from Dr. G. C. Creelman, President of the College. This was followed by a paper in his usual charming style by Mr. Frank Morris on "The Life-history of a Hobby-horse," giving reminiscences of the dawn and growth of his love for Nature and his development as an Entomologist. The special address of the evening was given by Mr. J. J. Davis, of West Lafayette, Indiana, on "President-day Problems in Entomology," which was listened to with great appreciation and interest. At the close of the meeting the members were hospitably entertained by Dr. Creelman with a smoker at his residence.

The meetings were continued during the morning and afternoon of Thursday, during which the officers for the ensuing year were elected, and the following papers read:

"Economic Entomology in Quebec," by Father Leopold; "Insects of the Season in Ontario," by Mr. W. A. Ross and Prof. Caesar; "Aphids—Their Human Interest," by Dr. A. C. Baker, Washington, D.C.; "A Method for the Preservation of Insect Larvæ and Pupæ," by Dr. F. Slater-Jackson, McGill University, Montreal; "Some Insect Problems in the Prairie Provinces," by Mr. Norman Criddle; "The Recovery of the Brown-tail Parasite, *Compsilura*, in new Brunswick," by Mr. J. D. Tothill; Presidential Address, by Prof. Caesar; "Oestrids"(with lantern slides), by Dr.S. Hadwen;" Further notes on the Control of the Cabbage-root Maggot," by Mr. Arthur Gibson; "Some chapters of the early history of Entomology" (with lantern slide portraits), by Prof. Lochhead; 'On the Genitalia of Primitive Insects" (with illustrative diagrams), by Prof. E. M. Walker; "The Pear Psylla," by Mr. W. A. Ross; "Notes on certain species of Bees indigenous to both Canada and Great Britain," by Mr. F. W. L. Sladen; "Control of the Apple Maggott," by Prof. Caesar and Mr. W. A. Ross; "The role which Insects play in the food of Trout," by Mr. W. A. Clemens. Most of these papers will be published in full in the next Annual Report of the Society.

It was decided to hold the next meeting at Ottawa in the autumn of 1919.

The election of officers for the ensuing year resulted as follows: President, Prof. L. Caesar, Ontario Agricultural College, Guelph; Vice-President, Arthur Gibson, Ottawa; Secretary-Treasurer, A. W. Baker, O.A.C., Guelph; Curator, Eric Hearle, Guelph; Librarian, Prof. C. J. S. Bethune, O.A.C., Guelph. Directors: J. M. Swaine, Ottawa; C. E. Grant, Orillia; Dr. A. Cosens, Toronto; F. J. A. Morris, Peterborough; J. W. Noble, Essex; J. F. Hudson, Strathroy; W. A. Ross, Vineland Station; Editor of the "Canadian Entomologist," Prof. E. M. Walker, Toronto; Delegate to the Royal Society, the President.

C. J. S. B.

NOTES ON THE DELPHACIDÆ IN THE BRITISH MUSEUM COLLECTION.

BY F. MUIR, HONOLULU, T. H.

When tabulating the genera of Delphacidæ* I was unable to place some genera with any certainty, as I was only acquainted with them through descriptions, which did not mention the characters which I used for primary divisions. Thanks to the kindness of the British Museum authorities I have been able to examine the Delphacidæ in their collection and to make the following notes upon them.

I wish to point out that *Delphacodes* Fieb. (*Delphax* and *Liburnia* of some authors) and allied genera are difficult to deal with, and unless great care be exercised, confusion will arise whenever one goes beyond a comparatively small faunistic area. The species of these genera can only be identified with any certainty by the use of the genitalia; not only should the characters found in the pygofer, anal segment and genital styles be used, but the aedeagus or penis should be dissected out. Many species have a wide geographical distribution and a large range of colour variation, which has led to synonymy. The demarcation between *Delphacodes* Fieb. and its allies is not definitely settled, and will not be until a study of species from various parts of the world shows us the range of variation within the genera. It is, therefore, with reservation that one must synonymize at the present time.

Canyra Stål.

The four species standing under this name, *C. strigulosa* Walk., *C. revertens* Walk., *C. retrahens* Walk. and *C. vittifrons* Walk. are the same as *Ugyops*, but they have a longitudinal depression along the *first* joint of the antennæ. I have not seen the type species of the genus.

Epibidis Fowler.

This genus is congeneric with the four species under *Canyra* and has the *first* antennal joint sulcate.

Ugyops Guein.

Delphax longicornis Walker and *Delphax media* Walker, both belong to this genus.

Consualia Distant.

I cannot separate this from *Ugyops*.

Onkelos Distant. = *Punana* Muir.

Ilburnia White. = *Nesosydne* Kirkaldy.

Delphax simulans Walk. belongs to this genus.

Ilburnia nephelias (Kirk.) = *I. disjuncta* (Muir).

Ambarvalia Distant.

The tibial spur is cultrate, half the length of the first tarsus, convex on both sides, with three teeth on the hind margin. The spur places this insect in the *Alohini*, otherwise the insect has a superficial resemblance to the Tropidocephalini.

Upachara Distant.

The genus has the spur small, thick, with a tooth at the apex, but none on

*Canadian Entomologist 1915, page 296 e. o.

the hind margin. I consider it should be placed in the Tropidocephalini. The carinæ of the head and thorax are obscure.

Pundaluoya Kirkaldy.

The type of this genus, *Delphax ernesti* Kirby, has the tibial spur cultrate, thick, concave on the inner surface, without teeth on the hind margin. I place it in the Tropidocephalini. The carination of the head is similar to that of *Belocera* Muir but, apart from the spur, the terete antennæ distinguishes it from that genus as well as from *Perkinsiella* Kirk. There is no carination on the lateral margin of the pronotum.

The genus *Peregrinus* Kirk. is quite distinct in general facies, shape and carination of head and thorax. The six species under the genus I place as follows:

1. *Pundaluoya ernesti* (Kirby). Type.
2. *Pundaluoya simplex* Dist. Typical. This only differs in the lighter colour from *P. ernesti* and is represented by a female. Only the capture of the male will decide if this be only a colour variety or not.
3. *Pundaluoya simplex* Dist. = *Peregrinus maidis* (Ashmead).
4. *Pundaluoya insignis* Dist. = *Perkinsiella insignis* (Dist.).
5. *Pundaluoya facilis* Dist. = *Perkinsiella facilis* (Dist.).
6. *Pundaluoya pulchella* Dist. = *Phyllodinus pulchella* (Dist.).

The front legs of this species are flattened, otherwise it would be a *Dicranotropis*.

Zuleika Distant.

First tarsus slightly longer than the other two together, spur as long as the first tarsus, broad, laminate, with small teeth on the hind margin. Lateral carinæ of pronotum slightly diverging curved. I cannot separate this genus from *Chlariona*.

Opiconsiva Distant. = *Delphacodes* Fieb.

1. *O. fuscovaria* Dist. = *Delphacodes puscovaria* (Dist.).
2. *O. insularis* Dist. = *Megamelus furcifera* (Horv.).
3. *O. derelicta* Dist. = *Megamelus furcifera* (Horv.).

This is a light female specimen of *O. insularis*.

4. *O. modesta* Dist. = *Delphacodes modesta* (Dist.).
5. *O. balteata* Dist. = *Megamelus furcifera* (Horv.).

The second specimen under this name is a different species.

6. *O. colorata* Dist.

The genitalia of this species are similar to *M. furcifera* (Horv.), but the head and thorax are black, except in the two brachypterous specimens, in which there is a light mark down the middle of the thorax.

7. *O. gloriosus* Dist.

One specimen without abdomen, similar to *M. furcifera* (Horv.).

Nilaparvata Distant. = *Delphacodes* Fieb.

The type of this genus is a damaged male, but it is in good enough condition to enable me to be sure of the synonymy of the species.

1. *Nilaparvata greeni* Dist. = *Delphacodes sordescens* (Motsch.) = *Delphacodes anderida* (Kirk.).

I was in doubt as to whether *D. sordescens* was the same as *D. anderida* until I had examined the Indian specimens.

2. *Nilaparvata mahensis* Dist. = *Delphacodes mahensis* (Dist.).

Toya Distant. = *Delphacodes* Fieb.

This genus is described as having a transverse ridge between the eyes, but it has the same carination of the vertex as *Delphacodes* (*Liburnia* of some authors); the medio-basal carina dividing the two basal areas is obscure. The pronotal lateral carinæ slightly divergingly curved, not reaching the hind margin. Vertex as wide as long. Second joint of antennæ slightly more than twice the length of the first. First hind tarsal joint slightly longer than the other two together, spur broad, laminate, as long as the first tarsus, small teeth on the hind margin.

Toya attenuata Dist. = *Delphacodes attenuata* (Dist.).

Kalpa Distant = *Delphacodes* Fieb.

1. *Kalpa aculeata* Dist. = *Delphacodes sordescens* (Motsch.).

This is represented by one female, the type, which, on account of the difference in coloration appears to have more pronounced carinæ on the head than has the male. This species and *D. bakeri* Muir, are peculiar in having small spines on the basal joint of the hind tarsus.

Akilas Distant.

I cannot separate this genus from *Gelastocephalus* Kirk.

Hapalornelus Stol.

The spur of this genus is narrow, pointed and thickened, with the inner surface distinctly concave, with many small teeth on the hind margin. The pro- and metanota each have three carina. The long, narrow wings constricted in the middle where the cross-veins are, distinguish it from other genera.

Sogata Distant.

The type of the genus, *S. dohertyi* Dist., is represented by one female. The first hind tarsal joint is longer than the other two together; tibial spur laminate, many fine teeth on hind margin, not so long as the first tarsal joint. Second joint of antennæ more than twice the length of the first. Vertex, longer than wide, base wider than apex; length of face three times the width. This comes very close to *Kelesia*.

1. *Sogata dohertyi* Dist.

2. *Sogata sternalis* Dist. Very near to *Kelesia kirkaldyi*, but it is necessary to dissect out the aedeagus.

3. *Sogata pusana* Dist. Very near to *Kelesia fieberi* Muir, but it is necessary to dissect out the aedeagus.

4. *Sogata distincta* Dist. = *Megamelus furcifera* (Horv.). The type and two other specimens are as above, while four other specimens under this name are *Sogata pusana* Dist.

5. *Sogata pallescens* Dist. Five specimens including the type are *Megamelus furcifer* (Horv.), while eight other specimens under this name are *Delphacodes sordescens* (Motsch.).

6. *Sogata thoracica* Dist. = *Delphacodes thoracica* (Dist.).

Delphax unicolor Walk., from Hudson Bay is a nymph and not of a delphacid.

Matutinus Distant.

This genus was placed among the Cixiini, but it is a Delphacid, which I consider to be indistinguishable from *Chlorionidea* Fieb.

ODONATA OF THE FRANCONIA REGION, NEW HAMPSHIRE.

BY R. HEBER HOWE, JR., CONCORD, MASS.

Mrs. Annie T. Slosson's captures of Odonata in Franconia, made now over a decade ago, have already attracted odonatologists to a recognition of this interesting region. Franconia is thus the type locality of *Gomphus borealis* Needham, and *Somatochlora minor* (Calv.), and five of Dr. Scudder's species were first described from the White Mountain region. It has been difficult, however, to limit the scope of this paper to just the township, and impractical to take a definite radius, for lying so near the Connecticut Valley, a very varied topographic region would be included, when it seems more interesting and proper to make the paper one on the mountain and foothill stations. I am, therefore, including the records made for the immediate region of the higher White Mountains, a region I think often referred to by Hagen and others on odonate labels as "White Mts." The list thus includes the notable records and type stations of Dr. S. H. Scudder on Mt. Washington, and at The Glen, and records of Dr. P. P. Calvert at Fabyan's, Dr. G. M. Allen at Intervale in 1899, etc.

My own collecting in this region includes one day's trip made in 1916, from southern New Hampshire,north through the Profile Notch and south again by the Crawford (Psyche 24:45-53, 1917), and during the past summer when I was a resident of Franconia from June 24 to August 5, and during a two days' trip on June 1 and 2. One of the interesting features of my list is, not so much that I failed to find many species recorded by Mrs. Slosson over her long years of collecting in the region, but that in one summer I should have taken a considerable number of common species which it seems she certainly would have found: facts indicating very probably changes or local extensions of insect ranges in this region.

Zygoptera.

AGRIONIDÆ.

1. *Agrion amatum* Hagen.

   June to July. Mrs. Slosson writes me, "There are not many bodies of water around Franconia where he was not to be found twelve years ago.—Pond Brook, Streeter Pond, Black Brook, along the Gale River, everywhere." Dr. Allen found it common at Intervale by the river, last seen on July 29. This species I was unable to find at all in the entire region.

2. *Agrion æquabile* Say.

   June to July. Dr. Allen found it along the Saco River from June 27 to July 3.

3. *Agrion maculatum* Beauv.

   June 20 to 27.

   I found it common about the brooks leading out of Echo and Profile Lakes, uncommon on Black Brook, and at Pearl Lake, Lisbon. It was taken at Intervale by Dr. Allen from June 20 to July 12. There is a male in U. S. N. Museum taken at Franconia by Mrs. Slosson.

CŒNAGRIONIDÆ.

4. *Lestes congener* Hagen.
   August and September. Dr. Allen took three specimens in the Saco meadows at Intervale,—July 3 to 26. There is a specimen in the U. S. N. Museum taken at Franconia by Mrs. Slosson.
5. *Lestes disjunctus* Selys.
   June to August. Mrs. Slosson collected this species at Franconia, June 26, and Dr. Calvert at Fabyan's. Between July 16 and 29 I found it common at Mill Pond, Lyman, and at Pearl Lake, Lisbon. It was taken commonly at Intervale and North Conway by Dr. Allen, from June 21 to Sept. 13, and by a collector named Skinner at Jackson.
6. *Lestes eurinus* Say.
   June. Dr. Allen took three specimens at a small pond near Saco River, North Conway, on June 29, the northernmost station in New England for the species.
7. *Lestes forcipatus* Rambur.
   June to August. Dr. Allen took several specimens in the Saco meadows, Intervale, from June 21 to August 8.
8. *Lestes inequalis* Walsh.
   June and July. Mrs. Slosson collected this species in June at Franconia, and Dr. Allen at Intervale from July 3 to 26 in the Saco meadows.
9. *Lestes rectangularis* Say.
   June 22 to Sept. 18. Mrs. Slosson collected it at Franconia, and Dr. Allen at Intervale, and North Conway in the Saco meadows and at Pudding Pond.
10. *Lestes uncatus* Kirby.
    June. Mrs. Slosson secured it at Franconia, and Dr. Allen two females, (determination doubtful) on June 27 in the Saco meadows.
11. *Lestes unguiculatus* Hagen.
    June 12. There is a specimen in the Museum of Comparative Zoölogy at Cambridge labeled "White Mts.," and I took one specimen at Streeter Pond (upper) which flew from my hand after capture, and which I am reasonably sure was of this species. Mrs. Slosson writes me she has taken it at Franconia.
12. *Lestes vigilax* Hagen.
    July and August. Dr. Allen secured it at Pudding Pond, North Conway, from July 1 to August 21.
13. *Argia moesta* Hagen.
    Dr. Allen collected it at Pudding Pond, North Conway.
14. *Argia violacea* Hagen.
    June and July. I took specimens from July 17 to 31 at Partridge Lake, Littleton, and at Forest Lake, Whitefield. Dr. Allen found it common at Intervale from June 20 to August 9.
15. *Enallagma calverti* Morse.
    June to August. I found it common at Profile and Echo Lakes, Franconia, from June 27 to August 12, and took one specimen at Lonesome Lake, Lincoln, July 4.

16. *Enallagma cyathigerum* Charp.

July. Mrs. Slosson collected it at Franconia, and Selys records it from Hermit Lake, Mt. Washington. I took it on July 4 commonly about Lonesome Lake, Lincoln.

17. *Enallagma aspersum* Hagen.

July to August. Dr. Allen took several specimens in the Saco meadows, at Pudding Pond and Echo Lakes, North Conway, from June 19 to August 21. He remarks, "Larger than usual, but apparently of this species." There is a specimen in the U. S. N. Museum from Echo Lake, North Conway, taken in 1890.

18. *Enallagma ebrium* Hagen.

July and August. I took it commonly at Streeter Pond, Franconia, and at Mill Pond, Lyman, from July 3 to 26. Dr. Calvert secured it at Fabyan's in August.

19. *Enallagma hageni* Walsh.

June to August. There is a male in the U. S. N. Museum from Franconia collected by Mrs. Slosson, and Dr. Allen took it commonly in the Saco meadows from June 20 to August 6. I found it common at Streeter Pond, Franconia; Partridge Lake, Littleton; Pearl Lake, Lisbon; Forest Lake, Whitefield, from July 3 to July 31.

20. *Nehalennia irene* (Hagen).

July. There is a male in the U. S. N. Museum collected by Mrs. Slosson at Franconia and Mt. Washington. Dr. Allen took it at North Conway on July 1, and I found them common at Streeter Pond, Franconia; Mill Pond, Lyman; Partridge Lake, Littleton, and at Bowles' Pond on Lafayette Brook, from July 3 to 29.

21. *Amphiagrion saucium* Burm.

June to July. Mrs. Slosson collected it at Franconia,—Dr. Allen on the Saco meadows, Intervale, from June 19 to July 10, and I secured several specimens at Mill Pond, Lyman, on July 16 to 17.

22. *Chromagrion conditum* Hagen.

June to July. Mrs. Slosson collected it at Franconia, Dr. Allen in the Saco meadows, Intervale, from June 22 to July 6,—there is a male in the U. S. N. Museum collected by Mrs. Slosson at Franconia, and I took a male at Profile Lake on July 20.

23. *Ischnura posita* Hagen.

There is a specimen in the Museum of Comparative Zoology labeled "White Mts."

24. *Ischnura verticalis* Say.

June to September. There is a male in the U. S. N. Museum collected at Franconia by Mrs. Slosson,—Dr. Allen took it commonly at Intervale from June 19 to September 13,—Dr. Calvert collected it at Fabyan's,—Skinner took it at Jackson,—there is a specimen from North Conway in the Museum of Comparative Zoology,—and I found it common at Streeter Pond, Franconia; Mill Brook, Lyman; Forest Lake, Whitefield; Partridge Lake, Littleton; Pearl Lake, Lisbon, and at Bowles' Pond, Lafayette Brook, Franconia, from July 3 to 31.

This is one of the most abundant and evenly distributed species in New England.

Anisoptera.

Aeschnidæ.

25. *Cordulegaster diastatops* Selys.
June to August. Mrs. Slosson took it at Franconia, and there is a specimen in the U. S. N. Museum collected by her. Dr. Allen took it in the Saco meadows, Intervale, from June 22 to July 1, and it was reported from the "White Mts." by Selys.

26. *Cordulegaster maculatus* Selys.
June to July. Dr. Allen took it at Diana's Baths, North Conway, and in the Saco meadows, Intervale, from June 19 to 22,—and I found it common at the outlets of Echo and Profile Lakes from July 20 to 27.

27. *Ophiogomphus colubrinus* Selys.
Recorded from the "White Mts." by Mr. Banks.

28. *Ophiogomphus aspersus* Morse.
June and July. Dr. Allen took two males and a female on Mt. Bartlett on June 24 and July 20, and a female at Intervale on July 4.

29. *Ophiogomphus mainensis* Packard.
Recorded from the "White Mts." by Selys, and from Franconia by Mrs. Slosson.

30. *Gomphus albistylus* Hagen.
July 20 to August 1. I found it common at the outlet from Echo Lake between the above dates.

31. *Gomphus borealis* Needh.
One of the type specimens was collected by Mrs. Slosson at Franconia. Dr. Allen took a female of *G. descriptus* (?) in the Saco meadows, June 21, which may belong here.

32. *Gomphus exilis* Selys.
June and July. I found tenerals at Echo Lake on July 20; an adult at Profile Lake July 27, and an adult at Pearl Lake, Lisbon, on July 25. Dr. Allen found it common at North Conway and Intervale from June 19 to 29.

33. *Gomphus parvulus* Selys.
June. Hagen recorded it from the "White Mts." in June. Mrs. Slosson from Franconia, and on June 28 I took a female near Lafayette Brook, Franconia, where I saw two others.

34. *Gomphus spicatus* Hagen.
June. Mrs. Slosson found it at Franconia on June 17. Dr. Allen took it in the Saco meadows, Intervale, from June 20 to 24.

35. *Gomphus brevis* Hagen.
June. Dr. Allen took both sexes on the Saco meadows, Intervale, from June 20 to 24.

Note.—*Gomphus notatus* Ramb., was probably taken at Campton, but the mis-spelling of the locality recorded makes the record doubtful.

36. *Basiæschna janata* Say.
June and July. Recorded from the "White Mts." by Hagen. I

found it at Echo Lake from June 30 to July 20. Dr. Allen took one at Intervale on July 4 in the Saco meadows.

37. *Anax junius* Drury.
July. I saw one at Streeter Pond, Franconia, on July 3. Mrs. Slosson reports one on the Gale River on June 20.

38. *Aeshna canadensis* E. Walker.
July and August. Recorded from the "White Mts." by Shurtleff. Dr. Calvert took it at the White Mt. House, at Franconia, and at Fabyan's. I found it common at Mill Pond, Lyman, on July 29.

39. *Aeshna constricta* Say.
August and September. It was taken at Hermit Lake, and Fabyan's by Dr. Calvert, and by Dr. Allen at Carter's Notch, and Intervale from August 21 to September 18. It is probably that some of the latter material should have been referred to *A. umbrosa*, a closely related species since described.

40. *Aeshna eremita* Scudd.
August. The type was taken at Hermit Lake, Mt. Washington, by Dr. Scudder, and it was also taken there by Mrs. Slosson, and a specimen of her collecting is in the U. S. N. Museum. I took it at Profile Lake August 12, 1916, and it was common at Lonesome Lake, Lincoln, on August 1. Undoubtedly undetermined material collected in July to September at Carter's Notch by Dr. Allen belongs here.

41. *Aeshna juncea* Linn.
August. It was recorded from the "White Mts." by both Scudder and Hagen. Mrs. Slosson also took it at Franconia.

42. *Aeshna cærulea septentrionalis* Burm.
It was recorded from the "White Mts." by both Scudder and Hagen.

43. *Aeshna umbrosa* E. Walker.
August. Mrs. Slosson took it at Franconia, and a specimen collected by her is in the U. S. N. Museum. It was recorded from the "White Mts." by Sprague, and from Hermit Lake by Scudder. I took a specimen at Lonesome Lake, Lincoln on August 1, and one in Franconia on the same day.

44. *Aeshna verticalis* Hagen.
July to September. Dr. Allen took it at Hermit Lake, Mt. Washington; at Carter's Notch; at Intervale and North Conway from July 22 to Sept. 11. In view, however, of the southern range of this species it would seem probable that his specimens were misdetermined. *A. canadensis*, a very closely related species, undescribed in 1899, was probably the insect captured.

Libellulidæ.

45. *Macromia illinoiensis* Walsh.
June. Dr. Allen took a male at Intervale on June 18.

46. *Dorocordulia libera* Selys.
Mrs. Slosson took it in Franconia.

47. *Helocordulia uhleri* Selys.
June. I took a male on June 25 at Echo Lake, Franconia.

48. *Somatochlora albicincta* Burm.
July and August. Drs. Calvert and Scudder found it at Hermit Lake, Mt. Washington. Dr. Allen at Carter's Notch on July 24. I found it at Lonsome Lake, Lincoln, from July 4 to August 1, and at Profile Lake, Franconia, from July 20 to 27.

49. *Somatochlora cingulata* Selys.
July. Hagen reported it from the "White Mts.," and Dr. Allen took four specimens at Carter's Notch on July 22.

50. *Somatochlora forcipata* Scudd.
July. Mrs. Slosson took it at Franconia and on Mt. Washington. Dr. Scudder's type was taken at "The Glen, White Mts.," and I took it at Profile Lake on July 20.

51. *Somatochlora elongata* Scudd.
July and August. Dr. Scudder's type was taken in the "White Mts." at Hermit Lake, Mt. Washington, and Mrs. Slosson took it at Franconia, and a specimen collected by her is in the U. S. N. Museum. Dr. Allen took it in the Saco meadows, Intervale, from Aug. 16 to 21 and I took two specimens at Profile Lake, July 27.

52. *Somatochlora minor* Calvert.
June. One of Dr. Calvert's types came from Franconia, where it was also taken by Mrs. Slosson on the Butter Hill Road.

53. *Somatochlora tenebrosa* Say.
August. Dr. Allen took one at Intervale on August 15.

54. *Somatochlora walshii* Scudd.
August. Dr. Scudder's type was taken at The Glen, "White Mts."

55. *Cordulia shurtleffi* Scudder.
June to August. Dr. Scudder's type was taken at Hermit Lake, Mt. Washington. Mrs. Slosson took it at Crawford Notch and Franconia, and I took it at Echo Lake, June 27.

56. *Tetragoneuria canis* MacLach.
Mrs. Slosson took one example of this species at Franconia.

57. *Libellula exusta* Say.
June and July. Mrs. Slosson took it at Franconia, and I found it at Streeter pond, Franconia, from July 3–12. Dr. Allen took it at Intervale from June 19 to July 28.

58. *Libellula pulchella* Drury.
July. Mrs. Slosson took it at Franconia, and Dr. Allen at Intervale from July 20 to Aug. 31. I found it common at Pearl Lake, Lisbon, on July 25, and at Mill Pond, Lyman, on July 29.

59. *Libellula quadrimaculata* Linn.
June and July. Mrs. Slosson found it at Franconia, and I found it common at Mill Pond, Lyman, July 16, and saw one specimen at Pearl Lake, Lisbon, on July 25.

60. *Plathemis lydia* Drury.
June and July. Mrs. Slosson found it at Franconia, and Dr. Allen at Intervale from June 22 to July 24.

61. *Nannothemis bella* Uhler.
July. Dr. Allen took it at Pudding Pond, North Conway, from July 1 to 28, and I found it common at Mill Pond, Lyman, July 16 to 29.

62. *Sympetrum costiferum* Hagen.
July and August. Mrs. Slosson took it at Franconia, and a specimen of her collecting is in the U. S. N. Museum. Dr. Allen took it from July 28 to Aug. 21 at North Conway and Intervale. I found it common at Streeter Pond, Franconia, and at Forest Lake, Whitefield, from July 12 to 31.

63. *Sympetrum rubicundulum* Say.
July and September. Mrs. Slosson took it at Franconia and Mt. Washington; Dr. Calvert at Fabyan's; Hagen records it from Hermit Lake, "White Mts.;" and Dr. Allen took it from July 4 to Sept. 1, at North Conway and Intervale. I found it at Pearl Lake, Lisbon, and at Mill Pond, Lyman, from July 25 to 29.

64. *Sympetrum obtrusum* Hagen.
July and August. Dr. Calvert took it at Fabyan's, and Dr. Allen at North Conway and Intervale from July 4 to Sept. 1. I took a single male at Pearl Lake, Lisbon, on July 25. Mrs. Slosson took it at Franconia.

65. *Sympetrum scoticum* Donovan.
Mrs. Slosson took one example at Franconia. It has never been taken again in New England.

66. *Sympetrum semicinctum* Say.
July and August. Hagen recorded it from the "White Mts."; Mrs. Slosson from Franconia; Dr. Calvert from Fabyan's; and Dr. Allen took one at Intervale on Aug. 16. I found it at Streeter Pond, July 12, and at Mill Pond, Lyman, on July 17.

67. *Sympetrum vicinum* Hagen.
Mrs. Slosson took it at Franconia; Dr. Calvert at Fabyan's; and Dr. Allen at Intervale from Aug. 10 to Sept. 13.

68. *Leucorrhinia frigida* Hagen.
July. Mrs. Slosson took it at Franconia and Mt. Washington, and Dr. Allen on July 1, at Pudding Pond, North Conway.

69. *Leucorrhinia glacialis* Hagen.
June and July. Mrs. Slosson took it at Franconia, and on Mt. Washington. Hagen recorded it from the "White Mts." Dr. Allen at North Conway from June 21 to July 1. I found it common at Lonesome Lake, Lincoln, on July 4, and rare on Aug. 1.

70. *Leucorrhinia intacta* Hagen.
June and July. Mrs. Slosson took it at Franconia, and on Mt. Washington. Dr. Allen found it common at Intervale from June 20 to July 4. I found it at Streeter Pond, Franconia on July 3, and at Mill Pond, Lyman, on July 17.

71. *Leucorrhinia hudsonica* Selys.
Mrs. Slosson took it at Franconia, and on Mt. Washington.

72. *Leucorrhinia proxima* Calvert.
Mrs. Slosson took it at Franconia, and on Mt. Washington, and there is a specimen in the U. S. N. Museum collected by her. Hagen recorded it from the "White Mts."

THE IDENTITY OF THE WHEAT MIDGE IN ONTARIO.

BY W. A. ROSS, DOMINION ENTOMOLOGICAL LABORATORY, VINELAND STA., ONT.

In connection with the re-appearance in Ontario of the wheat midge or "red weevil" in fairly large numbers in 1917 and in lesser numbers this year, it is worth while recording that our species is *Thecodiplosis mosellana* Gehin, and not as we thought, *Cecidomyia*, or *Diplosis, tritici* Kirby. This summer I reared a considerable number of adult midges from larvæ collected in 1917 in Welland and Lincoln Counties and submitted them to Dr. E. P. Felt, who, after making a careful examination, sent me the following report: "I have decided that the species is with very little question *Thecodiplosis mosellana* Gehin. I find on looking up our records that we reared the same insect in 1912 from wheat heads collected at Batavia, N.Y., and the probabilities are, so far as this country is concerned, that this is the destructive wheat midge. . . . I am well satisfied that this is not the *Cecidomyia*, or *Diplosis, tritici* Kirby unless the characterizations and illustrations of this insect are erroneous, something we are hardly warranted in assuming."

Fig. 1.—Wheat Midge (*Thecodiplosis mosellana* Gehin.), much enlarged.

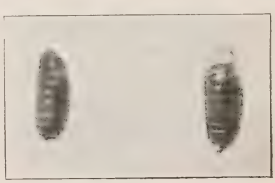


Fig. 2.—Maggots of Wheat Midge, much enlarged. The larva on the right is within its larval case.

CATOCALA ULALUME STRECK. VS. CATOCALA CAROLINA HOLLAND.

BY G. H. FRENCH, CARBONDALE, ILL.

In September, 1877, Herman Strecker described *Catocala ulalume* in his serial, "Lepidoptera Rhopaloceres et Heteroceres," page 132. In the April number of the Bulletin of the Brooklyn Entomological Society for 1880, page 97, Mr. Strecker describes *Catocala dejecta*. I have taken both of these in this (Jackson) County, Ill., and if my memory serves me correctly a specimen of *ulalume* was submitted to Mr. Strecker for identification.

In his book, "The Moth Book," Dr. W. J. Holland figures *Catocala carolina* as a new sub-species—the date of copyright of both being 1903.

This season I have taken a number of *Catocala ulalume*, some of them of the size of Dr. Holland's figure, while others are larger. Why is not Dr. Holland's *C. carolina* Mr. Strecker's *C. ulalume?* The markings are the same and they are constant. I would not class it as a form of *L. dejecta* without breeding. I tried to get eggs this season to breed it but failed. I always find *C. ulalume* on hickory trees, sometimes several on the same tree, having much the habit of *C. flebilis*.

A NEW SPECIES OF ARGIA (ODONATA).

BY CLARENCE H. KENNEDY, RALEIGH, N. C.

Argia rita, n. sp.

Holotype.—Female, collected in the Santa Rita Mts., Arizona, July, by F. H. Snow, and now in the Snow collection at Kansas University, Lawrence, Kansas. The label does not give the year, but gives the elevation as 5 to 8,000 feet. The male is unknown.

It is difficult to even surmise the nearest relatives of this species. The shape of the lateral lobe of the mesostigmal lamina suggests that of *agrioides*, but in *agrioides* there is no pit beneath it.

Length of abdomen 30 mm., length of hind wing 26 mm.

Female.—Colour: labium pale, labrum bluish (?), face and head otherwise violaceous except the ventral surfaces which are pale straw. Each postocular area bounded anteriorly and posteriorly by a narrow bar of black.

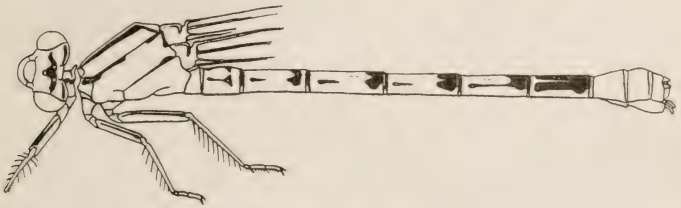


Fig. 3.—*Argia rita:* colour-pattern of type.

Prothorax violaceous, darker above, the side with a sinuous line, the dorsum with a heavy Y mark, the fork opening caudad.

Mesothorax and metathorax violet becoming paler on the sides. Mid-dorsal keel pale but edged by a very narrow, mid-dorsal, black stripe which widens above but fades out below. Pits of mesostigmal laminæ black. Antealar ridges black. A small, black spot on the upper part of the mesinfraepisternum. Humeral stripe narrow in the lower half, narrowing to a hair line above but widening into an oval spot at the alar ridge. Second lateral suture with a hair line of black. Pterostigmata brown. Legs with a narrow anterior stripe on the femur and a pale brown stripe on the ventral side of the tibia, otherwise bluish gray.

Abdomen violaceous on segments 1 and 2, brown on segments 3 to 7, and blue on segments 8 to 10. The following black markings occur (see fig. 3): a pair of stripes on segment 2, mere hair lines with the posterior end of each

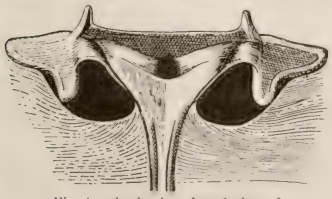


Fig. 4.—*Aogia rita:* dorsal view of mesostigmal laminæ.

Fig. 5.—*Argia rita:* lateral view of mesostigmal laminæ.

enlarged into a triangular spot; an apical ring, incomplete below on segments 2 to 6; a saddle-shaped spot on the apex of segments 3 to 6. This is connected

anteriorly on segment 6 with a lateral line on either side which appears on segments 3 to 5 as a detached antero-lateral spot. Segment 7 with the dorsum black except for a narrow space across the anterior end and the anterior two-thirds of the mid-dorsal line which are pale.

This female is distinguished at once by the two enormous pits or depressions on the anterior ends of the mesepisterna. There is one under each mesostigmal lamina. See figs. 4 and 5.

In the figure (3) of the colour-pattern the abdomen is slightly rotated.

This description should have appeared in the paper on new Argias, recently published in the Canadian Entomologist, but was overlooked.

SOME NEW LACHNIDS OF THE GENUS LACHNIELLA.

(HOMOPTERA–HEMIPTERA.)

BY H. F. WILSON, MADISON, WIS.

The genus *Lachniella* is now understood to be the correct genus for most of the Lachnids formerly placed in the genus *Lachnus*. The type of the true genus Lachnus is *Lachnus fasciatus* Burmeister, a species definitely determined upon by European aphidologists. This species has but one branch to the median vein, while Lachniella has two forks. The writer has under preparation a *Monograph of the Lachninæ of North America*, but it now seems impossible to have the illustrations printed until after the war, and so the following new species are presented at this time.

Lachniella inoptis, n. sp.

From material collected by Mr. Theo. Pergande at Washington on *Pinus inops?* Two slides containing one alate and four apterous specimens both labeled *Lachnus inoptis*, n. sp. Types in collection of U. S. Bureau of Entomology.

Apterous viviparous female.—Antennæ light at the base and dusky at the tip. Femora of all legs dark, front tibiæ entirely black. Tibiæ on middle and hind pair of legs light coloured at the base and black over the distal two-thirds. Antennæ long and slender, the sixth segment finger-like and slightly shorter than the fourth. Third segment approximately equal to the fourth and fifth together; fifth considerably larger than the fourth. Third and fourth segments without sensoria, fifth with one large sensoria at the distal end. Cornicles with a large, acutely sloping base. Cauda acute, anal plate slightly disked. Hairs on antennæ, legs and body distinctly spine-like and long.

Measurements.—Length of body 3.25 mm. Length of antennal segments, III, 0.64 mm.; IV, 0.31 mm.; V, 0.37 mm.; VI, 0.22 mm. Total length 1.76 mm. Beak, III, 0.25 mm.; IV, 0.25 mm.; V, 0.12 mm. Total length 2.08 mm. Length of hind tibiæ 2.39 mm.; hind tarsus, 0.25 and 0.37 mm.

Alate viviparous female.—Antennæ light coloured throughout the third segment except a small part at the distal end, fourth and fifth segments light dusky at the base, darker at the tip, sixth segment entirely dusky. Femora dark except at the base, tibiæ dark at the knees and along the distal one-third, the basal two-thirds light-coloured. Third antennal segment with a single sensoria near the distal end, fourth segment with none, fifth segment of one antenna with one large sensorium at the distal end, the other one with an

additional smaller one at the centre. The beak extends slightly beyond the hind pair of coxæ. Nectaries large and volcano-shaped. Wing venation typical for the genus. Hairs upstanding, long and thick, distinctly spine-like.

Measurements.—Length of body 3.25 mm. Length of antennal segments: III, 0.64 mm.; IV, 0.31 mm.; V, 0.35 mm.; VI, 0.23 mm. Total length 1.7 – mm.? Beak: III, 0.27 mm.; IV, 0.23 mm.; V, 0.1 mm. Total length 2 mm. Length of hind tibia 2.4 mm.; hind tarsus 0.25 and 0.37 mm.

Lachniella thunbergii, n. sp.

Described from five slides containing a number of oviparous females and one alate male. Three of the slides also contain apterous specimens of another species. No description of the latter has been attempted. The following notes from Mr. Theo. Pergande's records were furnished me by Mr. Baker. Types in collection of U. S. Bureau of Entomology.

Apterous oviparous female. — Specimens in balsam, colour cannot be determined. Antennæ in balsam clear except at tip, distal end of third and fourth, and all of fifth and sixth antennal segments, deep brown, nearing black. Legs with knees dark brown, first and second pair with tibiæ light in the middle and dark at the ends. Hind tibiæ with clear area extending only from near base to one-third the entire length; tarsi and other portions dark brown. Body, legs and antennæ with setaceous upstanding hairs.

Antennæ reaching to second pair of coxæ. Third and fourth segments with a single small, round sensoria near the distal end. Fifth with two large sensoria toward the distal end. Nectaries bell-shaped and of medium size. Anal plate bilobed. Hind tibiæ with numerous small sensoria.

Measurements.—Length of body 3.4 mm. Length of antennal segments: III, 0.46 mm.; IV, 0.21 mm.; V, 0.23 mm.; VI, 0.2 mm. Total length 1.25 mm. Length of beak 1.67 mm. Length of hind tibiæ 2.23 mm. Length of hind tarsus 0.29 mm.

Alate Male.—Antennæ black throughout. Front legs with femora yellowish at the base and brownish black toward the knee, knee nearly black, tibiæ light brown, being darker at the base and at the tip, tarsi dusky brown to black. Middle legs the same. Hind legs with tarsi, tibiæ and distal two-thirds of femora brownish black. Antennæ long and stout, and the third, fourth and fifth segments with numerous raised sensoria of variable size. Wing venation as in other species of this group. Nectaries appear to be much larger than in the apterous forms and with a much wider cone-shaped base.

Measurements.—Length of body from vertex to tip of abdomen, 2.25 mm. Length of antennal segments: III, 0.7 mm.; IV, 0.29 mm.; V, 0.146 mm.; VI, 0.21 mm. Total length 1.7 mm. Length of beak 1.77 mm. Length of hind tibiæ 2.17 mm. Length of hind tarsi 0.31 mm.

Lachniella vandykei, n. sp.

From material collected at Hemphry, Washington, by E. C. Van Dyke on Picea sp., May 28, 1914. Original material in alcohol, descriptions from balsam mounts. Types in writer's collection.

Apterous viviparous female.—Antennæ light toward the base and dusky toward the tip. Legs light toward the basal portion and dusky otherwise. Nectaries and cauda dusky to black. Antennæ with the third segment shorter

than the fourth, fifth and sixth. Fourth segment shorter than the sixth. Third segment with one, two or no sensoria, fourth with one, and fifth with two. Beak extending to base of nectaries. Nectaries large and broadly cone-shaped. Body globose, the abdomen being wider than long. Body, legs and antennæ set with fine, silky hairs of medium length.

Measurements.—Length of body 2.25 mm. Length of antennal segments: III, 0.41 mm.; IV, 0.187 mm.; V, 0.23 mm.; VI, 0.19 mm. Total length 1.18 mm. Beak: III, 0.21 mm.; IV, 0.17 mm.; V, 0.085 mm. Total length 1.78 mm. Length of hind tibiæ 1.46 mm. Hind tarsus 0.37 mm.

Alate viviparous female.—Antennæ with basal two-thirds of third segment light-coloured remaining part of third and all of the other segments dusky. Legs alike in colouring with basal portions of the femora and tibiæ except the joints light coloured, remaining portions dusky. Cauda and anal plate dusky to black. Antennæ with third segment shorter than the fourth, fifth and sixth together. Fourth segment shorter than the sixth. Third segment with six to eight large, round sensoria, fourth with one or two, and fifth with two. Beak reaching slightly beyond the nectaries, in normal specimens. In specimens somewhat shrunken it appears to reach to the tip of the abdomen. Nectaries large and broadly cone-shaped.

Measurements.—Length of body 2.26 mm. Length of antennal segments: III, 0.52 mm.; IV, 0.18 mm.; V, 0.27 mm.; VI, 0.21 mm. Total length 1.28 mm. Beak: III, 0.21 mm.; IV, 0.166 mm.; V, 0.083 mm. Total length 1.97 mm. Length of hind tibiæ 1.84 mm.

Lachniella gracilis, n. sp.

From a slide containing one apterous and two alate specimens collected by Theo. Pergande in the District of Columbia, May 27, 1894, on *Pinus inops*. Pergande applied the name here given, and it has been retained for that reason. Other slides in the material appear to be the same species, but in this case it seemed best to use but the one slide in setting this type. Types in the U. S. Bureau of Entomology collection.

Apterous viviparous female.—Antennæ light at the base and shading to dusky at the tip. Front and middle pair of legs light coloured except at the joints, third pair black except a small area just beyond the base. Cauda dusky to black. Third antennal segment approximately equal to the length of the fourth, fifth and sixth segments together. Fourth and fifth segments approximately equal in length, and the sixth shorter than the fourth. Third segment without sensoria although a single small one was observed on other specimens, fourth segment with one or two sensoria and the fifth with two nectaries cone-shaped, and unusually large. Cauda rather more angular than rounded, but with a widely rounded tip. Hairs short and much more inconspicuous at the base of the tibiæ than at the tip. Hairs at the base distinctly upstanding, those toward the distal end semi-erect.

Measurements.—Length of body 3.25 mm. Length of antennal segments: III, 0.46 mm.; IV, 0.21 mm.; V, 0.21 mm.; VI, 0.145 mm. Total length 1.22 mm. Beak: III, 0.25 mm.; IV, 0.187 mm.; V, 0.063 mm. Total length 1.86 mm. Length of hind tibiæ 2.45 mm. Length of hind tarsus 0.31 mm.

Alate viviparous female.—Antennæ light at the base of the third segment,

but dusky at the tip and shading into colour of other segments, the last one being nearly black. First and second pair of legs dark to black, except the greater portion of the tibiæ. Hind legs almost black throughout except a small, dusky area near the base. Antennal segments as in the apterous forms, except that the fifth segment is longer than the fourth. Third segment with six, the fourth with two or three, and the fifth with two large sensoria. The sensoria are unusually large as in the apterous forms, and are volcanic in shape rather than cone-shaped. The legs and antennæ are quite hairy, and those of the base of the tibiæ are upstanding while those farther outward are inclined. Cauda angular but broadly rounded at the tip.

Measurements.—Length of body 3.88 mm. Length of antennal segments: III, 0.52 mm.; IV, 0.187 mm.; V, 0.23 mm.; VI, 0.166 mm. Total length 1.2 mm. Beak: III, 0.21 mm.; IV, 0.175 mm.; V, 0.063 mm. Total length 1.9 mm. Length of hind tibiæ 2.42 mm.; hind tarsus 0.31 mm.

Lachniella pacifica, n. sp.

From materal bearing accession numbers of A. D. Hopkins and Theo. Pergande, collected at Eureka, California, May 19, 1903, on *Abies grandis*. Three alate specimens, several pupæ and one apterous specimen in poor condition. However, general characters of species quite distinct. Types in U. S. Bureau of Entomology collection.

Alate viviparous female.—In balsam the legs appear to have been fairly dusky throughout, although the hind pair are much darker than the others. Hind tibiæ with only a faint indication of the usually light area near the base of the tibiæ. Antennæ rather stout, third segment with seven to nine large sensoria, fourth with three and fifth with two. Nectaries mostly obscured but appear to be small and having a comparatively small base. Antennæ, legs and body with short hairs of rather fine texture. On the femora and base of the tibiæ they stand erect, while toward the tip of the latter they are inclined.

Measurements.—Length of body 1.86 mm.? Length of antennal segments: III, 0.41 mm.; IV, 0.166 mm.; V, 0.187 mm.; VI, 0.12 mm.? Total length 1.04 mm.? Beak: III, 0.187 mm.; IV, 0.145 mm.; V, 0.063 mm. Total length 1.78 mm. Length of hind tibiæ 1.86 mm.; tarsus 0.31 mm.

Lachniella atlantica, n. sp

From material collected by L. C. Bragg, at Webster, Massachusetts, June 19, 1909, on Pinus sp. Two slides containing three alate and five apterous forms. One slide in writer's collection, others in collection of C. P. Gillette.

Apterous viviparous female.—Antennæ light at base of third segment, remaining parts dusky black. All three pairs of legs black except the base of the femora, and a yellow area toward the base of each tibia. Third antennal segment approximately equal in length to the fourth and fifth together. Fourth segment slightly shorter than the fifth, and the sixth shorter than the fourth. Third segment with a single sensoria, fourth with one and fifth with two. Beak extending to the tip of the abdomen. Nectaries extremely large, volcano-shaped.

Measurements.—Length of body 2.37 mm. Length of antennal segments: III, 0.44 mm.; IV, 0.21 mm.; V, 0.23 mm.; VI, 0.166 mm. Total length 1.25 mm. Beak: III, 0.21 mm.; IV, 0.187 mm.; V, 0.063 mm. Total length 2.04 mm. Length of hind tibia 2.20 mm. Hind tarsus 0.31 mm.

Alate viviparous female.—Colour of antennæ and legs as in the apterous form. Third antennal segment approximately equal in length to fourth. Third antennal segment approximately equal in length to fourth. Third segment with six to eight large, circular sensoria, fourth with two and fifth with two. Nectaries extremely large. Beak extending to the base of the nectaries. Hairs on legs, body and antennæ fairly abundant and longer than those of other species in this group. Those on the femora and at the base of the tibiæ are not quite as upstanding as with other species in this group.

Measurements.—Length of body 2.39 mm. Length of antennal segments: III, 0.46 mm.; IV, 0.21 mm.; V, 0.23 mm.; VI, 0.145 mm. Total length 1.28 mm. Beak: III, 0.21 mm.; IV, 0.187 mm.; V, 0.063 mm. Total length 2 mm. Length of hind tibiæ 2.08 mm. Hind tarsus 0.33 mm.

Lachniella arizonica, n. sp.

Descriptions made from eleven specimens on three slides. Specimens collected on Pinus sp. at Williams, Arizona, June, 1901, by E. Q. Schwarz. Types in U. S. Bureau of Entomology collection.

Apterous viviparous female.—General colour characteristics cannot be determined. Antennæ with basal half of third segment light coloured, remaining segments dusky to black. Legs black, except bases of femora, and a small section of the tibiæ near their bases.

Antennæ extending to the third pair of coxæ, the third segment longer than the fourth, fifth and sixth together. Third segment with one to three small sensoria near the distal end. Nectaries large and with a wide, cone-shaped base. This species is entirely different from all other lachnids I have seen because the surface of the body is reticulated, and the spines on the antennæ, body and legs, except on the tarsi and caudal plate, have the appearance of being capitate.

Measurements.—Length of body 5 to 6 mm. Width 3 mm. Length of antennal segments: III, 0.96 mm.; IV, 0.35 mm.; V, 0.27 mm.; VI, 0.17 mm. Total of beak 1.7 mm. Length of hind tibiæ 5.12 mm.

Alate viviparous female.—Colour characteristics cannot be determined. Dark and light coloration of antennæ and legs as in the apterous forms. Antennæ reaching to base of third pair of coxæ. Third segment about equal in length to the fourth, fifth and sixth segments, and with from two to four irregular-sized sensoria along the distal half. Fourth with two, and fifth normally with two. Body does not show reticulations as in apterous forms, but the hairs are similar and are strongly spine-like.

Measurements.—Length of body 5 to 6 mm. Length of antennal segments: III, 0.9 mm.; IV, 0.39 mm.; V, 0.37 mm.; VI, 0.166 mm. Total length 1.98 mm. Length of beak 1.9 mm. Length of hind tibiæ 5.2 mm. Cauda broad and rounded at the tip.

(To be continued.)

RECENT CANADIAN PUBLICATIONS.

(Continued from Vol. L, p. 427).

CANADIAN BARK-BEETLES. PART II—A PRELIMINARY CLASSIFICATION WITH AN ACCOUNT OF THE HABITS, INJURIES AND MEANS OF CONTROL. By J. M. Swaine. Bulletin No. 14 (Technical Bulletin) Dept. of Agriculture, Entomological Branch, Ottawa. Issued Sept. 6, 1918. 143 pp. 31 pls.

It is only within comparatively recent years that the importance of the Bark-beetles as enemies of North American forests has been fully appreciated even by the forest entomologist. Every year the necessity of stricter economy in the conservation and utilization of our forests becomes more urgent, and it is, therefore, fortunate that we have in Canada so able an authority as Mr. Swaine as a source of information, both practical and scientific, on this group of depredators.

The first part of this bulletin, which was published in 1917, contains descriptions of a large number of new species of bark-beetles. The second part treats of their habits, bionomics and classification, as stated in the title, and has been prepared with the object of enabling students and practical foresters to identify the Canadian species of this group of insects. It is divided into four sections, the first entitled "The Beetles and their Habits;" the second, "Bark-beetle Injuries and the Means of Control;" the third, "Structural Characters of the Bark-beetles," and the fourth, "Classification. A Preliminary Arrangement of the Canadian Bark-beetles."

Section 1 is an admirable account of the general life-history of these insects, based upon an intimate first-hand knowledge of a great variety of species. The different types of egg tunnels, larval mines, methods of oviposition, and other details of their habits are described with conciseness and precision. Among other interesting features in this section are the statements that the so-called ventilation tunnels are used mainly as turning-niches by the females during oviposition and as storage places for boring dust and that the nuptial chambers are used by some species for the same purposes.

In Section II the species of bark-beetles are grouped under three headings, primary enemies, secondary enemies and neutral species. Primary enemies are those species which commonly attack and kill healthy trees, the most important of these being certain large forms belonging to the genus Dendroctonus. Secondary enemies are those species which habitually breed in the bark of dying trees and logs, but these are frequently injurious in that they kill weakened trees which might otherwise recover. Secondary enemies may become of primary importance under conditions favourable for their rapid reproduction, as in the case of various species of Ips. All of the Canadian species under normal conditions seem to prefer to breed in dying or weakened trees. Some of the twig-boring species may be abundant enough to cause some injury, while others may be actually beneficial by hastening the death of the lower branches of pines and spruces, thus helping to produce cleaner trunks. The neutral species are of no economic importance as they breed only in dying or dead bark.

Attention is called to the effect which neglected slashings produce in increasing the number of scattered dying trees in the vicinity on account of the favourable conditions thus brought about for the breeding of bark-beetles.

These conditions are frequently the cause of outbreaks of one or more species, which may be local (sporadic) or more general (epidemic) according to the nature of the species of beetle involved in the attack. At the present time outbreaks of a serious character are still in progress in certain parts of British Columbia, caused by two species of Dendroctonus, the Western Pine Bark-beetle (*D. brevicomis* Lec.) and the Western White Pine Bark-beetle (*D. monticolæ* Hopk.). Both of these species are destroying yellow pine in Southern British Columbia, while the latter species is also attacking western white pine and lodgepole pine.

Various other conditions favouring bark-beetle outbreaks also described in this section, followed by an account of the natural factors and artificial methods of control.

The greater part of the bulletin, constituting Section III and IV is devoted to the taxonomy and systematic treatment of the species. The external structures, in so far as they are of value in the determination of genera and species, are described in detail, but the internal characters are omitted, as they are useful only to the expert.

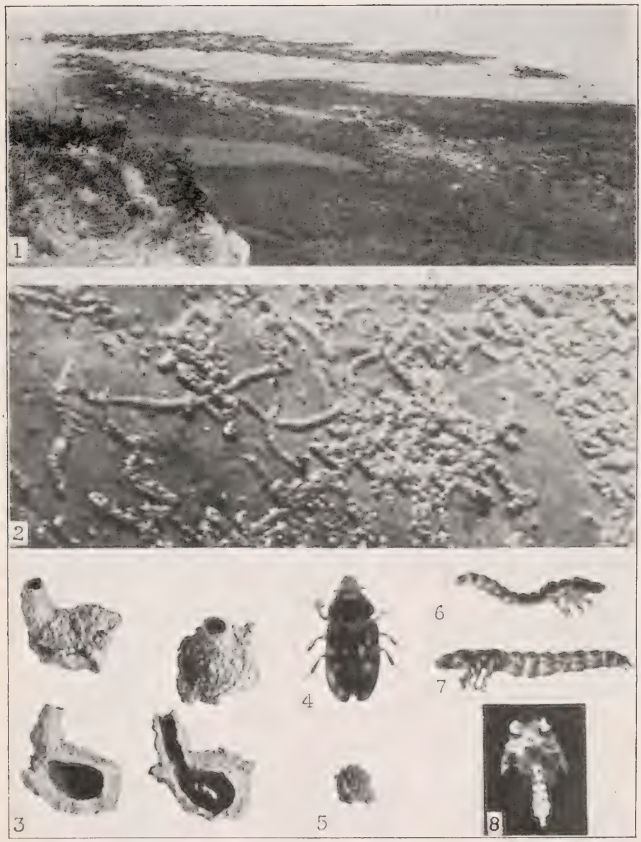
The bark-beetles constitute the superfamily Ipoidea (Scolytoidea), all the Canadian species except one (*Platypus wilsoni* Sw., fam. Platypodidæ) belonging to the family Ipidæ. Keys for the separation of the families, subfamilies, genera and species are given, and not only all the Canadian species but also the majority of those found in the Northern United States are included, as many of the latter may eventually be discovered in Canada.

In the detailed account of the species, descriptive notes or full descriptions are given when necessary, with the names of the host tree and a brief statement of the geographical distribution. Ten new species are described, and 135 species are definitely recorded from Canada.

The illustrations are beyond criticism. There are 31 plates, the great majority being heliotype reproductions of photographs and drawings by Mr. A. E. Kellett. The drawings are second to none we have ever seen, and the beauty of their general appearance is in no way marred by the extraordinary minuteness with every detail is rendered. The photographs, showing the tunnels in the bark and wood and other features of the work of the beetles and their larvæ are likewise extremely fine.

Altogether this remarkable work deserves very special praise. It is one of the finest contributions to Canadian entomology that has ever been published, and great credit is due to the author, the artist and the Dominion Entomological Service.

Mailed January 28th, 1919.



THE HABITS OF HETEROCERUS BEETLES.

1. Mud bar where the beetles breed. 2. Burrows made by the larvæ. 3. Pupal cases. 4. Adult. 5. Eggs. 6. Larva. 7. Larva ready to pupate. 8. Pupa.

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POPULAR AND PRACTICAL ENTOMOLOGY.

NOTES ON THE HABITS OF HETEROCERUS BEETLES.

BY G. B. CLAYCOMB, UNIVERSITY OF ILLINOIS, URBANA, ILL.

In the hot, dry days of summer, when the creeks run low and the mud bars become numerous along the margins of the streams, a common sight on this recently deposited mud is the network of lines which mark and ramify the surface. Investigation shows clearly that some small animal has pushed its way through the soft alluvium and formed little tunnels in the freshly exposed sediment left by the receding water. These little subterranean passages were a source of great perplexity to the writer until the summer of 1916, when the entire mystery was revealed as if by magic.

Along a small creek in western Illinois on a day late in July, the entire life-history of the little builder of the burrow was found in all completeness. Near the water (pl. I, fig. 1), just beneath the surface of the soft squashy mud, were the tunnels, freshly made. Farther back on the dryer portion of the bar, the tunnels were more numerous and the elevation of the soil which marked the passages was more distinct, due to the drying of the earth. Still farther back the lines formed, in places, an almost unbroken mat, so extensive had the network become (pl. I, fig. 2). On the higher, firmer portions of the deposit, among the older less distinct galleries, were little cases with chimney-like extensions projecting from the mud (fig. 3).

Here then was the life-history of these interesting beetles in all its completeness within this very limited area. The adult beetle (fig. 4) was found to be the maker of the tunnels in the fresh mud near the water. Several were captured within the burrows, and others, when disturbed, forced their way out through the mud and flew away. In these newly constructed passages are laid the eggs in small masses (fig. 5). The eggs hatch into active running larvæ (fig. 6) which greatly extend the home already started for them by the adult, growing to a length of 7 or 8 millimetres, the larvæ construct for themselves the mud chambers with the peculiar little chimneys extending upward from them (fig. 3) The openings of these chimneys are usually closed near the top by a very thin layer of dry mud. These structures become firm and strong after they are dry. In the chamber the larva changes to a pupa (fig. 8). Beside the larvæ and pupæ, several adults were found within the cells (fig. 3).

The beetles were identified for me by Mr. A. B. Walcott, of The Field Museum of Natural History, Chicago, who says: "The sending represents two species, the larger and paler ones are *Heterocerus pallidus* Say; while the smaller and darker ones are *Heterocerus tristis* Mann." The adults of these two distinct species were found together in the same limited area and in the same kind of pupal cases. Their habits apparently are identical.

The smaller beetles measured on an average 4.3 mm. in length, the larger ones were slightly longer. At the time of pupation the larvæ measured from 7 to 8 mm. in length (fig. 7). The cases averaged 10 mm. in their longest dimension.

When the place was visited again a few days later, a rise of the stream had obliterated the entire colony, and nothing remained but a plain mud bar.

NEW AND LITTLE-KNOWN AMERICAN BEES.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

The new species described all belong to parasitic genera.

Cœlioxys panamensis, n. sp.

♂. Length about 10 mm.; black, with the legs (except coxæ), tegulæ, first abdominal segment and second laterally all bright ferruginous, under side of abdomen darker red; mandibles reddish in middle; face and front densely covered with appressed, very pale, yellow hair; eyes pale reddish, with short hair; antennæ black, with penultimate joint (except dusky apex) and basal half of last joint dull yellowish red; third joint conspicuously shorter than fourth; vertex densely punctured, but a smooth area at each side of the ocelli; mesothorax densely and coarsely punctured, the anterior margin with a bow-shaped band of pale fulvous hair; a band of similar hair posteriorly, partly on mesothorax and partly on scutellum, and a spot at each side behind the tegulæ; axillar spines long, flattened, appearing slender from above; scutellum densely and coarsely punctured, with a median carina, but no projecting tooth; mesopleura with a broad band of white hair in front and behind; wings strongly brownish; first r.n. jointing second s.m. nearly as far from base as second from apex; anterior coxæ with short, flattened spines; abdomen dorsally finely punctured, shining; hair-bands slender, tinged with yellowish; apex with slender lateral spines; slender, widely divergent, inferior apical spines; and broad, obtuse superior apical lobes, shorter than the inferior spines.

Canal Zone, Panama (*A. H. Jennings*), U. S. National Museum. Not closely related to any species known to me; in my table of males it runs near *C. sayi* and *C. hirsutissima*. The peculiarly coloured antennæ are quite distinctive.

Cœlioxys nigrofimbriata, n. sp.

♀. Length about 9.5 mm.; black, with the tegulæ and legs ferruginous; the abdomen is entirely black above, but dark red (with white hair bands) beneath; antennæ entirely black; mandibles red, black at apex; face covered with erect brown hair, but the sides with white tomentum; clypeus simple; eyes red, with short hair; mesothorax surrounded with pale fulvous hair; mesothorax and scutellum with very large punctures, but the shining intervals conspicuous on disc; scutellum with a smooth median keel; axillar spines rather short, curved; wings strongly brownish; recurrent nervures equally distant from ends of second s.m.; anterior coxæ with short spines; abdomen above highly polished, sparsely punctured, with very narrow whitish hair-bands; sixth segment with very minute punctures, and a median keel; last ventral segment produced far beyond last dorsal, sharply pointed at end, not notched at sides, but densely fringed with black hair; apex of last dorsal also with black hair, but its sides before apical part fringed with white hair.

Manaos, Brazil, (*Miss H. B. Merrill*), U. S. Nat. Museum. In Schrottky's table of Brazilian species this runs to *C. amazonica* Sky., but is smaller, and apparently less densely punctured on thorax above. Schrottky also omits to refer to the more striking characters of the abdomen, present in our species, and presumably absent in his. In the tables of Holmberg and Friese it runs nearest to *C. remissa* Holmbg., but differs in the sculpture of the scutellum.

Cœlioxys clypeata Smith, variety a.

♀.—First abdominal segment red above. The pubescence of the large clypeal lobes is reddish.

Trinidad, West Indies, June, (*Aug. Busck*). U. S. Nat. Museum.

Cœlioxys deplanata Cresson.

♀.—Tlahualilo, Mexico, July, 1905, (*A. W. Morrill.*)

Cœlioxys crassula, n. sp.

♀.—Length about 8.5 mm.; black, robust, with the legs (except coxæ and trochanters) and tegulæ ferruginous; mandibles black; clypeus simple, short and very densely punctured; antennæ black, third joint about as long as fourth; eyes black or almost (not greenish or reddish); vertex with a smooth space on each side next to eye; pubescence dull white, the abdomen with five entire bands, but no short, oblique ones; mesothorax and scutellum with dense large punctures, the latter with posterior margin straight; axillar spines moderate; wings dusky; anterior coxæ with small spines; abdomen very broad at base, well punctured; apical dorsal segment keeled its whole length, ending with an angle of perhaps 60 degrees; apical ventral segment broad, not much turned downward at sides before end, the outer margin of the notch sharp.

Boulder, Colorado, in D. M. Andrew's nursery, at flowers of cultivated *Helenium*, Oct. 10, 1918. (*W. P. Cockerell*). In Crawford's table this runs exactly to *C. octodentata* Say, but it differs by the entire keel on last dorsal segment, shorter last ventral segment, and colour of eyes. On the same flowers, at the same time, were males of *Melissodes semiagilis* (Ckll.). On Oct. 12, the weather being unusually fine and warm for the time of year, I went to the same spot in search of more *C. crassula*. I did not find any, but from the *Helenium* I obtained females of *Megachile brevis* Say, and males of *Halictus armaticeps* Cresson and *Colletes salicicola geranii* Ckll. I also collected a male *Megachile perihirta* Ckll. Immediately adjacent was a row of *Salvia pitcheri*, which was visited by *Bombus americanorum* Fabr., *Anthophora smithii* Cresson, *Pseudomelecta interrupta rociadensis* Ckll., and *Sphecodes lautipennis* Ckll.

Stelis aliena, n. sp.

♀.—Length about 8.5 mm.; with the general appearance, venation and pulvilli of *Dianthidium* (e. g., *D. bicoloratum* Smith), but no scopa, the ventral abdominal segments with thin fringes of hair; cheeks, vertex, occiput and mandibles (except teeth) bright ferruginous; two very broad black bands, beginning between the ocelli, pass down the front to the clypeus, where they become narrower; between these is a red band, the upper end of which (marked off from the red by a constriction) is orange; between the black bands and the eyes, down to the clypeus, is orange suffused with red; clypeus reddish black, the lower corners red; antennæ red; head very densely punctured throughout, as also the thorax, the punctures of scutellum much larger than those of mesothorax; prothorax black, the tubercles with an orange spot; pleura black, with thin white hair, its upper part mainly occupied by a large red patch; mesothorax black in middle, laterally dull red, shading into black at sides, but lateral and anterior margins yellow, except middle of anterior margin, the yellow anteriorly forming triangular patches, which are extended

as orange lines across the disc between the black and red areas; axillæ yellow; scutellum bright red, prominent; metathorax black; tegulæ red, very finely punctured; wings fuliginous; legs red, hind femora suffused with blackish; abdomen black, with an interrupted yellow band on first segment, and four yellow spots each on second to fifth; the broad apical segment wholly black; first three segments shining and rather sparsely punctured, the others with large dense punctures.

San Bernardino, Paraguay, (*K. Fiebrig*). U. S. Nat. Museum. This is the first recognized South American *Stelis*, and from its resemblance to the species of *Dianthidium* of the same general region, it seems possible that it represents an independent development, not derived from the *Stelis* of the Northern Hemisphere. *Dianthidium nudum* Schrottky appears to be congeneric, and may be called *Stelis nuda*.

Dianthidium bicoloratum (Smith).

Male.—Clypeus yellow, greater part of mesopleura and hind margins of first four abdominal segments red. Carcarana, Argentina (*Bruner* 18).

Dianthidium multifasciatum (Strand).

San Bernardino, Paraguay (*K. Fiebrig*).

Erratum. Can. Ent., p. 349. For *Nescorynura* read *Neocorynura*.

SOME NEW OR SCARCE COLEOPTERA FROM WESTERN AND SOUTHERN FLORIDA—II.

BY W. S. BLATCHLEY, INDIANAPOLIS, INDIANA.

(Continued from Vol. L., p. 424.)

Mycetophagus pini Zieg.—Three examples of what I take to be this uniform fuscous-brown species were taken at Dunedin in December. They were found on different occasions, two in fleshy fungi, the other by beating dead branches. Col. Casey, who has examined one of them, is inclined to doubt its being *pini*, stating that "they are not so elongate as that species and the antennal structure appears to be different." They accord, however, with all the brief descriptions of *pini*, the type of which was from North Carolina. No species of *Mycetophagus* has before been recorded from Florida.

Hister cœnosus Ehr.—This large well-marked *Hister* is recorded by Schwarz as "common in Northern Florida," but no records for the southern half of the State are known. Two specimens were taken at Dunedin, on Dec. 19 and March 29, respectively, both being sifted from carrion traps.

Hister lecontei Mars.—This widely distributed species does not seem to be previously known from Florida, at least no published record can be found. A single specimen was taken from beneath the lake beach debris near Moore Haven on March 3.

Hister coarctatus Lec.—Horn in his "Synopsis of U. S. Histeridæ"* says that this species occurs with *H. parallelus* Say, the latter having been previously mentioned by him as "occurring in Georgia, South Carolina and Florida." This indirect record is the only one I can find for Florida. A single

*Proc. Amer. Phil. Soc., XIII, 1873, 298.

specimen was taken at Dunedin on March 25 while sweeping huckleberry and other low vegetation.

Soronia undulata Say.—A specimen was given me by Dr. E. W. Berger, Entomologist of the Florida State Plant Board, who reared it from larvæ sent in to him as damaging the fruit of guavas at Bradentown. It has not before been recorded from the State. Horn* gives its range as Middle States to Utah.

Cryptarcha strigata Fab.—An introduced European species not before reported from Florida. Two specimens were taken, one at Dunedin, February 11, while beating, the other at La Belle, February 27, by sweeping.

Trogosita hubbardi Leveille.—A submaritime species described from Biscayne Bay, and since taken by Schwarz (Ms.) at Key West and Punta Gorda, Fla., and Cayamas, Cuba. Two specimens were beaten from Florida button-bush, on Hog Island, March 14.

Elater manipularis Cand.—LeConte gives** the range of this species as "Canada to Texas." I can find no record of its occurrence in Florida. Two specimens were taken at Dunedin in December, and one at Lakeland, Feb. 22, all by beating bunches of Spanish moss in which they were hibernating.

Dicerca punctulata Schön.—One specimen beaten from pine at Dunedin, Jan. 15. LeConte, in his Revision, gives its range as New York to Georgia. Not mentioned in any of the Florida lists.

Mastogenius subcyaneus Lec.—Several specimens of this small Buprestid are taken at Dunedin each spring by sweeping ferns and beating in Skinner's Hammock. I have also taken it at Eustis. Schwarz (Ms.) notes it from St. Augustine. There is no previous published record for the State.

Agrilus floridanus Cr.—A half dozen specimens of this handsome bronzed species were swept from huckleberry and other low shrubs at Dunedin during the latter part of March. It was described from northern Florida and is recorded elsewhere only from Tampa.

Agrilus cupricollis Gory.—This species was described from St. Augustine and has been taken by me at Ormond and Dunedin. At the latter place it begins to appear about March 10 and occurs on huckleberry and other low shrubs.

Taphrocerus albonotatus sp. nov.—Elongate, slender, strongly tapering behind. Black, shining, very sparsely and finely pubescent; the elytra with eight isolated white pubescent spots, arranged in three cross rows, two each in the first and third, and four in the second or middle row; the spots of the third row crescent-shaped, the others rounded or oblong, the first row at middle, the others equally spaced behind it. Head as broad as front of thorax, finely alutaceous, not punctate, the occiput with a wide, shallow, median impression. Thorax twice as wide as long, base slightly wider than apex, disk uneven, but less so than in *gracilis;* surface minutely alutaceous and with large, shallow, scattered ocellate punctures. Elytra at base slightly narrower than base of thorax, sides broadly sinuate in front of middle, straight and strongly converging from apical third to the obtusely rounded tips; disk with irregular rows of large shallow punctures, these becoming obsolete towards apex. Abdomen with

*Trans. Amer. Ent. Soc., VII, 308.
**Trans. Amer. Ent. Soc., XII, 1884, 9.

large, very shallow punctures, each enclosing a small oblong white scale. Length 3.5—4.5 mm.

Frequent in southern Florida, on huckleberry and other low shrubs in late fall and early spring. Taken by me at Lakeland, Ft. Myers, La Belle and Dunedin, October 20 to April 10. Confused heretofore with *T. gracilis* Say from which it differs by its more slender and more strongly tapering body, black colour without bronze tinge as in *gracilis*, and by the isolated white pubescent spots, the pubescence in *gracilis* coalescing to form two white cross bars on apical half of elytra. *T. puncticollis* Sz. is distinct by the punctate head and lack of elytral pubescent spots or bands. It has been taken by me at Okeechobee City, Bassenger and Dunedin.

Taphrocerus agriloides Crotch.—A half dozen specimens of this scarce form were taken near Moore Haven by sweeping low vegetation along the margin of Lake Okeechobee. It was described from Texas and is recorded by Schwarz as very rare at Haulover, Fla.

Brachys lugubris* Lec.—This name should be replaced in our lists either as a valid species or a well marked variety of *B. ovata* Web. The surface is black with a bluish tinge, never bronzed, the pubescence always white. The last ventral of male is not visible from above as in *ovata*, and its marginal teeth are much finer. In the female this segment is not truncate, as stated by Le Conte, but broadly rounded. About Dunedin it was swept from Ericads and low vegetation along the borders of lakes on several occasions in February and March, and was also taken under like conditions at Lakeland.

Calochromus perfacetus Say.—Two specimens of this Lampyrid were taken at Lakeland on Feb. 21. It was also found by me at Ormond on April 14. LeConte, in his synopsis of the family, gives its range as "Atlantic States," but this is the first record from Florida.

Chauliognathus pennsylvanicus DeG.—This species, whose general range is more northern than that of *C. marginatus*, was taken at La Belle on Feb. 27. It is mentioned in Schwarz's manuscript list as occurring at St. Augustine and Cresent City.

Phengodes floridensis sp. nov.—Elongate, slender. Pale reddish yellow, pubescent with yellow hairs; antennæ, except the two basal joints, apical or narrowed halves of elytra, inner wings and margins of dorsal segments of abdomen, fuscous. Head with deep transverse curved channel behind the eyes, the latter globose, prominent; occiput and front densely punctate, not grooved lengthwise; antennæ strongly plumose, half the length of body. Thorax slightly wider than long, convex, front angles rounded, hind ones acute, side margins flattened, horizontal, slightly narrowed in front, disk very finely and sparsely punctate. Elytra subulate, reaching scarcely beyond base of abdomen. Length 9 mm.

One male, swept from ferns in Skinner's Hammock northeast of Dunedin, March 19.

Eupactus obsoletus Fall.—A specimen taken at electric porch-light at Dunedin was received on June 15. Identified by Mr. Fall, who states that it has

*Trans. Amer. Phil. Soc., XI, 1859, 251.

not previously been reported from Florida. *E. punctulatus* Lec. has also been taken at light at Dunedin.

Copris inemarginatus Blatch.—An examination of the male genitalia of this species and of *C. anaglypticus* was kindly made for me by Prof. R. W. Dawson of Lincoln, Neb. He reports that the claspers are uniformly less elongate and less slender in *inemarginatus* than in *C. anaglypticus*. He examined also the genitalia of other species of *Copris*, viz., *mæchus minutus* and three tropical forms, and states that "the differences between the genitalia of these unquestionably distinct species are little if any greater than those between *inemarginatus* and *anaglypticus*." His conclusions therefore are but additional evidence that the Florida form was worthy of a distinctive name*.

Onthophagus alutaceus sp. nov. —Rounded-oval, small for the genus. Black, feebly shining, not at all bronzed; palpi, tarsi and front tibiæ brownish. Head of male without carina, sparsely punctate above, more closely near the margins, the clypeus with a broad, rather shallow triangular notch. Thorax twice as wide as long, longest at middle; sides straight in front, then rounded into base, the latter broadly rounded, sinuate near hind angles, distinctly margined; disk strongly convex, its front third declivent and with an obtuse triangular median projection; surface finely alutaceous, sparsely, evenly, coarsely and shallowly punctate, each puncture bearing a short, coarse, stiff, erect, brown hair. Elytra at base distinctly narrower than middle of thorax; striæ very fine; intervals wide, coarsely alutaceous, each with two rows of fine, aciculate punctures, each puncture bearing a fine, short, inclined yellow hair. Spur of hind tibiæ half the length of tarsi. Pygidium, femora and sterna coarsely, shallowly and sparsely punctate; abdomen almost smooth. Length 4 mm.

One male, taken on the wing at Dunedin, Jan. 7. Chas. Schaeffer, who recently published a review of the North American species of *Onthophagus*,** says it is undescribed form, close to a new species in his collection from Texas, which has the front tibiæ armed with a distinct, moderately long hairy pencil as in "*anthracinus, landolti*, etc.," this being absent in the Florida specimen. The broad, strongly alutaceous elytral intervals with rows of aciculate punctures resembling minute tubercles, taken in connection with the small size, black colour and notched clypeus, are the principal distinctive characters of *alutaceus*. It is closely related to *cribricollis* Horn, the latter being bronzed, with different sculpture of upper surface and broader clypeal notch.

Aphodius bicolor Say.—One specimen taken at Dunedin, March 18. The first record for the State.

Polyphylla occidentalis Linn.—One specimen taken at porch-light at Dunedin, June 10. Specimens in the Gainesville collection are from Lake City. The *P. occidentalis* of the Schwarz List was based on *P. gracilis*, there being no published record of true *occidentalis* from the State.

*In the last paragraph of the notes following the description of *C. inemarginatus* (Can. Ent., February, 1918), line 8 from the bottom of p. 55 should read "and take the punctures out of" instead of "and put the punctures in."

**Journ. N. Y. Ent. Soc., XXII, 1914, 290.

Heterachthes pallidum Hald.—Elongate, slender, cylindrical. Rather dark reddish brown or rufo-testaceous throughout, strongly shining. Thorax cylindrical, twice as long as broad, narrowed at base, finely, sparsely and irregularly punctate without callosities or antemedian constriction as in *quadrimaculatus*. Elytra twice as long as thorax, slightly wider at base, finely sparsely and irregularly punctate, each puncture bearing a very slender, erect hair. Under surface smooth, glabrous. Length 6.5 mm.

The above description, I take it, is that of the insect mentioned* as a variety of *H. quadrimaculatus* Newm., Haldeman's brief description following that of *H. quadrimaculatus*, being as follows: "Var. *pallidum*. Pale, posterior spots wanting. Three lines long." As described above the differences between the two forms are sufficient to restore Haldeman's name, if not as a valid species, at least as a good variety. One male was taken by beating in Skinner's Hammock northeast of Dunedin, March 23. The antennæ, as is usual with males of the genus, have joints 1 to 6 uniformly thickened, the second very small, globular; the terminal joints much more slender. *H. ebenus*, the only other species known from Florida, was taken at Moore Haven and Okeechobee City.

(To be continued)

THE NORTH AMERICAN DIPTERA DESCRIBED BY NILS S. SWEDERUS.

BY CHARLES W. JOHNSON, BOSTON, MASS.

In Kongl. Vetenskaps Academiens Nya Handlingar, 1787, vol. VIII, pt. 4, Swederus described seven Diptera, including two from North America. The author states that he has followed the classification of Linné, the genera of Fabricius being placed in parenthesis. On page 287 is described *Musca* (*Syrphus* Fabr.) *monoculus*, "Hab. in America Septentrionali." I am unable to identify this species. On page 288, *Musca* (*Syrphus* Fabr.) *americana* is described, "Hab. in America Sept." This is probably the species referred to as "*Musca tomentosa* Swederus" in Osten Sacken's Catl. N. Amer. Diptera, page 136, 1878, in the synonymy under "*Brachypalpus verbosus* (Harris) Walker," and later placed in the synonymy under *Criorhina verbosa* by Williston (Synopsis N. Amer. Syrphidæ, page 211, 1886). The name "*Musca tomentosa* Swederus" is evidently an error, as no species by that name was described by him. In regard to *Musca* (*Syrphus*) *americana* Swederus being the same as *C. verbosa* Walker, there seems to be too many discrepancies, the description agreeing far better with *Eristalis flavipes* Walker.

The name *Musca americana* was previously used by Fabricius 1775. On the other hand, *Syrphus americanus* was used by Wiedemann in 1830. Does the use of Fabricius' genus in parenthesis by Swederus invalidate the name used by Wiedemann? I am inclined to think it does, as the author's intention seems very clear, for, following this description, three other species are described in which only the genus *Musca* is used. To avoid confusion it seems necessary to rename Wiedemann's species. I, therefore, propose the name *Syrphus wiedemanni* n. n., placing *Musca* (*Syrphus*) *americana* Swederus in the synonymy under *Eristalis flavipes* Walker.

*Trans. Amer. Phil. Soc., X, 1847, 43.

LEUCOPELMONUS CONFUSUS, NORTON—TENTHREDINIDÆ.*

BY ALEX. D. MacGILLIVRAY, UNIVERSITY OF ILLINOIS, URBANA, ILL.

Norton in his "Catalogue of the Described Tenthredinidæ and Uroceridæ of North America," describes as a new species, *Tenthredo confusus*. This species was based upon a male received from the Smithsonian Institution. The only locality noted was the United States. The type of this species has been reported as lost and, so far as I am aware, no one has identified this species since.

In the Canadian Entomologist for 1893, Mr. W. Hague Harrington described a peculiar tenthredinid, *Tenthredopsis* (?) *annulicornis*. It is not unusual for species of Ichneumonidæ to have the proximal and distal segments of the antennæ black or dusky and the intermediate segments white. This is the first record of a species of Tenthredinidæ with antennæ coloured in this way. The female of this species has the fifth and sixth segments white and the others dusky. Such an arrangement of colour makes the female very easily recognized.

Mr. S. A Rohwer described a similar species from North Carolina under the name of *Perinura turbata*. The female of this species also has the fifth and sixth segments of the antennæ white.

There is included in my report on the Tenthredinoidea in the report of the Hymenoptera of Connecticut a new genus and species, *Leucopelmonus annulatus*, the female of which has similarly coloured antennæ. This species was based on specimens collected in New England. It was hoped that a careful study of all these species could be made before the description of *L. annulatus* was published, but this was impossible.

The description of Norton was based upon a male, but in the case of the species described by Harrington, Rohwer, and MacGillivray, specimens of both sexes were available for study. There is before me for comparison typical specimens of both sexes of these three latter species. While there are slight individual variations, I am unable to find any constant characters for separating them. The males agree perfectly with Norton's description of the male of *confusus*, and I believe that these four names all apply to a single species which is very constant in its structural and colorational characters.

Leucopelmonus MacG.

1917. MacGillivray, Bul. Conn. Geol. Nat. Hist. Surv., 22, 83.

Head broad between the compound eyes, nearly twice as broad as the eyes are along at the antennal foveæ; compound eyes with their mesal margins nearly parallel or only slightly converging ventrad; antennal plates not strongly developed, but distinct; malar space one-half as long as the first antennal segment; clypeus deeply emarginate, labrum broadly rounded; lateral ocelli slightly dorsad of a line connecting the dorsal corners of the compound eyes; antennæ with nine segments, the first distinctly longer than the second, segments of the flagellum not thickened or clavate; legs with the metacoxæ not reaching to the caudal margin of the third abdominal segment, metafemora not reaching the caudal end of the abdomen, and the claws deeply cleft; front wings with the radial cross-vein, the free parts of R_4 and R_5, the radio-medial cross-vein, and the free part of Sc_1 distinct; M_{3+4} originating from the cell R_5 and M_2 from the cell R_4; 2nd A a short, transverse vein; hind wings with the free part of R_4 and

*Contributions from the Entomological Laboratories of the University of Illinois, No. 57.

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the transverse part of M_2 wanting, the cells R_3 and M_1 not limited at the margin of the wing by a vein; abdomen with the basal plates not divided at middle.

This genus is related to Tenthredopsis and Rhogogastera, from the former of which it is separated by having the basal plates undivided and from the latter by lacking the free part of R_4, and the transverse part of M_2 in the hind wings of both sexes.

Leucopelmonus confusus Nort.

1869. *Tenthredo*. Norton, Trans. Amer. Entom. Soc., 2, 24.

1887. *Tenthredopsis*, Cresson, Syn. Fam. Gen. Hymen. Amer., 169 *annulicornis* Harrg.

1893. ? *Tenthredopsis*, Harrington, Can. Entom., 25, 61, *turbata* Rohwer.

1911. *Perineura*, Rohwer, Proc. U. S. Nat. Mus., 41, 408, *annulatus* MacG.

1917. *Leucopelmonus*, MacGillivray, Bul. Conn. Geol. Nat. Hist. Surv., 22, 83.

Female.—Head, including the clypeus, finely, densely, shallowly punctured; the clypeus narrowly, deeply emarginate, the bottom of the emargination transverse, the sides oblique, the clypeal lobes large, broadly truncated; the antennal furrows broad, deep, and distinct, more linear between the lateral ocelli and the caudal margin of the head, parallel; the caudal portion of the head distinctly margined, deeply interrupted by the antennal furrows; the postocellar area very convex, quadrangular; the ocellar furrow distinct, broadly rounded, connecting with the antennal furrows and a short, interocellar furrow continued as a slight V-shaped depression surrounding the median ocellus; the ocellar areas not elevated adjacent to the lateral ocelli, forming well elevated ridges continuous with the distinct antennal plates and elevated flat supraclypeal area; the median fovea wanting; the dorsal end of the supraclypeal area abrupt, forming the ventral boundary of the deep ocellar basin, extending from the supraclypeal area to the median ocellus, the ocellar basin variable in depth, the ventral portion sometimes smooth; a distinct lateral fovea adjacent to the dorsal end of each antennal plate; the antennæ with the third and fourth segments subequal or the third slightly longer than the fourth, the fourth distinctly longer than the fifth; the pronotum sparsely coarsely punctured; the median and lateral lobes of the mesonotum polished, with sparse punctures bearing setæ; the mesoscutellum and axillæ densely granular, the mesopostscutellum polished with a few punctures, the lateral portions sometimes slightly finely striated; the mesoscutum finely densely granular; the mesopleura with the dorsal portion finely densely punctured, gradually merging with the granular ventral portion and polished mesosternum; metapleura granular; the wings hyaline, the proximal half of the stigma pale, the veins including the costa brownish; the claws cleft, the inner lobe about one-fourth the length of the outer; the cephalic tibial spurs enlarged, angularly bifurcate at the distal end; the abdomen polished, sparsely setaceous; the saw-guides slender, the dorsal margin straight, the ventral margin rounded, continuous with the strongly obliquely convex distal portion, the dorsal and distal margins forming a sharp angle; the distal and ventral margin bearing long setæ; the cerci short and truncate; colour rufous shading to whitish with the following parts black: the first to fourth segments of the antennæ, the distal half or whole of the seventh,

and the eighth and ninth, the head except the supraclypeal area for the most part, the clypeus, the labrum, and some irregular marks on the postocellar area, sometimes represented by two black spots, an oval spot on each lateral lobe of mesonotum and a minute spot near the caudo-mesal angle of each oval spot, the metanotum and the sutures between it and the basal plates and first abdominal segment more or less, the ventral aspect of the mesopleura and metapleura, sometimes with a rufus spot on the mesopleura, variable in size and distinctness, mesosternum and metasternum, the coxæ except the distal portion, and a band at the distal end of the metafemora and metatibiæ; the labrum, antennal segments five and six, sometimes the proximal half of seven and the tegulæ white. Length 8–10 mm.

Male.—The male differs only in having a larger proportion of black and in having the rufous colour tending toward white; the antennæ are pale beyond the second segment, rufous or yellowish, the distal segments viewed in certain lights, whitish; the three distal segments of the abdomen usually black, the entire abdomen sometimes rufous; the pronotum in great part black; the mesopleura entirely black. Length 7–8 mm.

Habitat.—Ottawa, Ontario, (W. Hague Harrington); North fork of Swanaanoa River, Black Mountains, North Carolina (Nathan Banks and Franklin Sherman); Franconia, New Hampshire (Mrs. A. T. Slosson); Durham, New Hampshire (C. M. Weed); Hampton, New Hampshire (S. Albert Shaw); Ithaca, New York.

SOME NEW AMERICAN DELPHACIDÆ.

BY F. MUIR, HONOLULU, T. H.

Genus **Columbiana,** nov.

Head a little narrower than thorax; vertex slightly wider than long, apex slightly narrower than base, basal areas five-sided, nearly the length of the vertex with an oblong foveola in each, the diamond-shape cell small and projecting beyond the apical margin; length of face about twice the width, slightly narrowed between the eyes beyond which the sides parallel, median carina simple, slightly thickened at base; in profile vertex and face rounded; antennæ cylindrical, reaching to apex of face, first joint about as long as broad, second joint about twice the length of first and slightly thicker; clypeus tricarinate. Pronotum tricarinate, lateral carinæ divergingly curved posteriorly not reaching to the hind margin; mesonotum tricarinate. Hind tibia longer than the tarsi, first tarsus equal in length to the two others together; spur slightly shorter than the first tarsus, narrow, cultrate, concave on the inner surface, a tooth on apex but none on the hind margin. Media touching cubitus, a short cross-vein between media and radius.

This genus comes near to *Sogatopsis* Muir; if we disregard the spur it comes near to *Delphacodes* Fieb. and *Sogata* Dist.

Columbiana lloydi, sp. nov. Figs. 6-a, 7-a.

Male, macropterous. Castaneous, darker on pro- and mesonota and abdomen. Tegmina hyaline, veins brown with very fine granules, fuscous or brown over the basal half of costal cell and slightly so over clavus, with a darker mark at the apex of claval vein.

Opening of pygofer oblong, the ventral edge produced into three processes, the middle one broad and bifurcate, the lateral smaller and lanceolate; anal segment large without spines; genital styles straight, flat, narrow at apical fourth, apex truncate; aedeagus large, produced into a long, curved narrow apex with a curved spine at base of the narrow apex.

Length 2.6 mm.; tegmen 4 mm.

Habitat.—Almaguer Cauca, Columbia, 10,500 feet elevation (Lloyd).

Pissonotus megalostylus, sp. nov. Figs. 8-a.

Male, macropterous. Width of head including eyes 1.7 times the length including eyes, antennæ reaching nearly to the apex of clypeus, joints subequal in length, vertex longer than wide, apex slightly narrower than base; lateral pronotal carinæ straight, diverging posteriorly not quite reaching the hind margin; length of hind tibia subequal to tarsi, first tarsus slightly longer than the other two together, spur large, as long as first tarsus, laminate, small teeth on hind margin.

Light brown, darker between the carinæ of face and clypeus, along the posterior margin of pronotum, over the medio-lateral areas of mesonotum, the abdomen and third tarsus. Tegmina hyaline, median vein and all the apical veins brown, on the median vein all the brown extends into the neighbouring membrane, a brown mark at the end of commissure; wings hyaline with brown veins.

Opening of pygofer oval, margin entire; anal segment small with two small spines on medio-ventral edge; armature arising from the middle of the diaphragma as a cultrate projection; genital styles large, flattened, curved, in lateral view bent at right angles before middle, apex pointed the apical portion curled round into nearly a complete circle, a small projection where the curl begins.

Length 2.5 mm.; tegmen 4 mm.

Habitat.—Demerara River, British Guiana.

Megamelus timehri, sp. nov. Fig. 9.

Male, macropterous. In structure and colour similar to the macropterous *M. notula* (Germ.) to which it is closely related. Spur slightly longer than first tarsal joint, thin and broad with apex rounded, numerous small teeth on the hind margin.

Dark brown, carinæ of head, legs, antennæ and pygofer lighter brown; tegmina hyaline, veins brown with a few minute granules bearing black hairs; wings hyaline with light veins.

Pygofer on the same plan as that of *M. notula* (Germ.), the ventral margin with three emarginations, a semicircular median one and a pair of lateral ones deeper than wide; anal segment small, closely embraced by the pygofer; genital styles small, flat, outer edge slightly convex, inner edge straight or slightly concave, apex obtusely pointed.

Length 2.2 mm.; tegmen 3 mm.

Habitat.—Demerara River, British Guiana.

M. notula (Germ.) differs from this species in having the two processes between the emarginations on the ventral edge of the pygofer much narrower and pointed, the genital styles are more pointed and have a large projection at base, and the anal segment is not closely embraced by the pygofer. The variety *flavus* (Crawford) differs from *M. timehri.*

Fig. 6.—Dorsal view of head and pronotum of *Columbiana lloydi*.

Fig. 6a.—Face of same.

Fig. 7.—*C. lloydi*, full view of pygofer.

F g. 7a.—Lateral view of same.

F i g . 8. — *Pissonotus megalcstylus*, full view of pygofer.

Fig. 8a.—Lateral view of same.

Fig. 9. — *Megamelus timehri*, full view of pygofer.

F i g . 10. — *Chloriona fuscipennis*, full view of pygofer.

Fig. 11. — *Delphacodes guianensis*, full view of pygofer.

Fig. 12.—*Delphacodes subfusca*, full view of pygofer.

Chloriona fuscipennis, sp. nov. Fig. 10.

Male, macropterous. Length of vertex twice the width, apex slightly narrower than base, length of face two and one-half times the width, slightly wider on apical half; antennæ reaching to the base of clypeus or slightly beyond, first joint half the length of the second; hind tibia of equal length to tarsi, first tarsus longer than the other two together, spur nearly as long as first tarsus, wide, laminate, many small teeth on the hind margin; lateral pronotal carinæ diverging posteriorly, slightly curved, not reaching the hind margin.

Dark brown, front and middle legs lighter brown, antennæ, rostrum, hind legs, lateral portions of pronotum, middle of pro- and metanota yellowish or light brown. Tegmina hyaline, fuscous, an area over apex of costal and subcostal cells clear, infuscation darkest along cubital area, commissure white with a dark mark at apex, granules minute with black hairs; wings hyaline with brown veins.

Pygofer opening wide, dorsal emargination deep; anal segment sunk into emargination, round; genital styles long, straight, flat, narrowed on apical third, apex truncate.

Length 2.5 mm.; tegmen 3.4 mm.

Habitat.—Demerara River, British Guiana.

Delphacodes guianensis, sp. nov. Fig. 11.

Male, macropterous. Vertex as long as wide, length of face slightly more than twice the width, sides subparallel, slightly narrowed between the eyes; antennæ reaching slightly beyond the base of the clypeus, first joint more than half the length of the second (1 to 1.4); hind tibia longer than tarsi, first joint of hind tarsus as long as the other two together, spur large, as long as the first tarsal joint, broad, laminate, apex acute, small teeth on the hind margin.

Light brown or ochraceous; a minute black spot on the lateral carinæ of face in front of the ocelli, a slightly darker longitudinal mark down the tibiæ, abdomen darker with a light line down the middle of the ventral surface and on pleura. Tegmina hyaline, slightly yellow, veins yellow, granules fine with black hairs; wings hyaline with yellow veins.

Opening of pygofer slightly deeper than broad, anal segment small not closely embraced by pygofer, a pair of short, stout, curved, diverging spines on medio-ventral surface, their bases approximate; genital styles large, flat, broadest at apex which is truncate and oblique, outer edge slightly concave, inner edge produced into a process at the middle, which is longer than broad and rounded at apex.

Length 2 mm.; tegmen 3.3 mm.

Habitat.—Demerara River, British Guiana.

Delphacodes subfusca, sp. nov. Fig. 12.

Male, macropterous. Vertex slightly broader than long; antennæ reaching to base of clypeus, first joint about half the length of second; length of face about twice the width, slightly narrowed between the eyes, beyond which the sides are parallel; median carina furcate at base; hind tibia equal in length to the tarsi, first tarsal joint equal to the second and third together, spur as long as first tarsi at joint, wide, pointed, laminate, small teeth on the hind margin.

Light brown or ochraceous, darker between carinæ of head and over coxæ

and abdomen. Tegmina hyaline with light brown veins, granules very small bearing black hairs, a dark mark at end of commissure, wings hyaline with brown veins.

Opening of pygofer round, margin produced into a small lobe at each side of the anal segment; anal segment small with a pair of small, stout spines on the medio-ventral edge, touching at their bases and slightly diverging to the apices; armature or diaphragm small, Y-shape; genital styles long, flat, slightly curved, slightly narrowed at middle, apex truncate with the corners slightly produced.

Length 1.6 mm.; tegmen 2.0 mm.

Female lighter in colour, especially so on coxæ and abdomen.

Length 2.2 mm.; tegmen 2.8 mm.

Habitat.—Demerara River, British Guiana.

SAMUEL WENDELL WILLISTON.

In the death of Samuel Wendell Williston, on August 30, 1918, American entomology has lost one of its keenest students. Although his professional work lay mainly in palæontology, in which field he attained great distinction, he also ranked as the foremost American dipterist of his time and a world-authority in this branch of entomology.

The following brief sketch of his life is based upon, and largely quoted from, the admirable account by Prof. J. M. Aldrich, which appeared in the November number of the Entomological News (vol. XXIX, pp. 322-327, with portrait).

Samuel Wendell Williston was born on July 10, 1852, and was, therefore, 66 years old when he died. At this time and for some years previously he was Professor of Palæontology and Director of the Walker Museum in the University of Chicago. His boyhood was spent at Manhattan, Kansas, where he entered the Agricultural College, graduating in 1872. He began to study medicine in 1873, but in the following two years he spent the summer months in fossil-collecting expeditions in Western Kansas, the work being done for Prof. Marsh, of Yale University. After a winter at the Medical School of the University of Iowa, he visited Prof. Marsh in the spring of 1876, and this visit resulted in almost continuous employment with Marsh for nine years, until 1885, when he received his Ph. D., specializing in palæontology. He also managed to finish his medical course in 1880, and in 1886 was appointed demonstrator in anatomy at Yale Medical School. So great was his ability as an anatomist that he obtained a full professorship in Human Anatomy in the following year.

After three years in this position he accepted a call to the University of Kansas as Professor of Historical Geology and Palæontology. Twelve years of arduous and productive work followed, during which he helped to organize the Medical Department of the University and took on the deanship of the latter in addition to his other duties.

Though possessed of a vigorous constitution, his health began to give way under the strain of overwork, so that, after resigning from this post, he went to Chicago in 1902 as Professor of Palæontology, in which capacity he was able to concentrate upon his chosen specialty. Here he spent the last 14 years of his

life, beginning under some unexpected hardships and gradually working up to full recognition and honours.

Williston never held an official entomological position, but he found time to do much valuable work as a pioneer in dipterology. His interest in flies began to be serious about 1878, but he was virtually alone in the field in America, and the difficulties which confronted him in the identification of genera and species were almost overwhelming. After a year or two of slow and tedious effort, however, he came upon Schiner's Fauna Austriaca, in which he found great relief and satisfaction, for he was now able, through its excellent analytical tables, to trace all his American flies to their families and, in most cases, to their genera. "He was so impressed by the saving of time accomplished that his own publications coming later show the effect of this early experience on every page; everywhere he has the beginner in mind and is clearing the way for him.

"In a few years he began publishing tenative papers analyzing the American families and genera of flies. These he extended and enlarged in a pamphlet in 1888, and again in a bound volume in 1896; and in 1898 published a third edition still more complete, with 1,000 figures, his well-known Manual of Diptera. This third edition is his main contribution to entomology. It is a handbook unapproached by anything else dealing with a large order of insects. From necessity he published it at his own expense; it was eight years before the receipts from sales covered the cost of printing, but happily he lived to see this consummation.

"His other papers of his early period, 1881-89, dealt with Asilidæ, Conopidæ, Tabanidæ, and smaller groups, and especially with Syrphidæ, in which his fine monograph of 1886 is still in universal use, and by the taxonomic genius of its author has created in the United States an ineradicable belief that the family is an easy one, well adapted for the beginner to publish in; a mistaken belief, but highly complimentary to the monographer.

"From 1890 his more important papers were concerned with tropical Diptera (Mexico, St. Vincent, Brazil), and with bibliography. As his official duties grew more exacting, he gradually abandoned entomology, but he had as many farewell appearances as an opera singer, for he could not resist the temptation to come back again and again * * * But after 1896 he did little work on the order except in preparing the third edition of his Manual, which cost him two years of arduous work, as he drew 800 figures with his own hand. His deep interest in genera and his very wide acquaintance with them, together with his universally recognized taxonomic ability, made him in the period 1890-1900, the peer of Osten Sacken, Brauer and Mik as a world-authority in Diptera."

Williston exercised a stimulating and inspiring influence upon his students, with whom he associated himself intimately. Although he never gave any formal entomological courses, he gave much informal assistance to many who were interested in his special studies, and among these are some of our most eminent dipterists, as well as others who attained distinction in palæontology. "But his life work was mainly directed to the larger circle outside his own institution."

"His last years were full of honours. He was a delegate to the International Zoological Congress at Monaco; Yale University gave him an honorary D. Sc.;

he was chosen to the limited membership of the National Academy of Sciences, and the Entomological Society of America made him an Honorary Fellow, one of seven out of its membership of 600.

"He was married in 1880 to Annie I. Hathaway, of New Haven, who survives him together with three daughters and a son."

In his concluding paragraph Prof. Aldrich says: "More than any other of my teachers, he became my ideal of a scientific man; and if in later years my ideal took on larger proportions, so he too seemed to expand in his nature powers; and at the close of his life I still feel that a splendid and inspiring example of scientific work and achievement is contained in his career."

SOME NEW LACHNIDS OF THE GENUS LACHNIELLA.

(Homoptera-Hemiptera.)

BY H. F. WILSON, MADISON, WIS.

(Continued from page 22.)

Lachniella nigra, n. sp.

Descriptions made from specimens collected at Kilbourn, Wisconsin, August 18, 1917, on Pinus sp. Very abundant and found in colonies on the underside of the branches or on the trunk of young trees. General colour shining or a metallic chocolate brown, not pruinose. Colour notes from live specimens, other notes from alcoholic and balsam material. Types in the writer's collection.

Apterous viviparous female.—General colour metallic brown with the legs and antennæ black. After being in the balsam for a few months the antennæ and front and middle pair of legs became lighter, especially the tibiæ. Antennæ with the third segment being much stouter. Third segment approximately as long as the fourth, fifth and sixth together, the sixth being slightly longer than the fourth, and both less than the fifth. Third segment without sensoria, fourth with two small ones, and the fifth with one small sensoria near the middle, and a very large one at the distal end. Beak long, extending to the tip of the body. Nectaries very large and with a straight sloping base, cauda angled rather than rounded at the tip. Hairs abundant and of medium length.

Measurements.—Length of body 2.5 mm. Length of antennal segments: III, 0.5 mm.; IV, 0.187 mm.; V, 0.27 mm.; VI, 0.21 mm. Total length 1.34 mm. Length of beak 2 mm. Length of hind tibiæ 2.35 mm.

Alate viviparous female.—General colour bronze brown with antennæ and legs black. Colour notes made from live specimens, other notes from balsam mounts. After several months in balsam the antennæ and legs become lighter coloured. The antennæ from the base of the third segment, gradually becoming darker toward the tip, the last segment being dusky to black. The tibiæ of the first and second pair of legs excepting at the joints become quite clear, those of the hind pair continue to be dusky black. Third antennal segment approximately as long as the fourth, fifth and sixth. As in the apterous forms the antennæ taper somewhat, the last two segments being thicker than the preceding; from one to three sensoria are found on the distal end, except that occasionally two sensoria may occur near the end, and one larger one about the centre of the segment. Fourth segment normally with one sensorium, but two may occur.

Fifth segment with two large or one large and two small sensoria. Beak reaching to tip of abdomen, wings as usual in the genus. Nectaries not quite as large as in apterous forms, and cauda more rounded.

Measurements.—Length of body 2.25 mm. Length of antennal segments: III, 0.62 mm.; IV, 0.25 mm.; V, 0.27 mm.; VI, 0.187 mm. Total length 1.5 mm. Length of beak 2.15 mm. Length of hind tibiæ 2.6 mm.

Lachniella montana, new species.

Description made from three apterous specimens on one slide. Material sent to me by Prof. C. P. Gillette and designated as a new species by him under the name *Lachnus montanus* collected by Prof. Gillette at Cimmaron, Colorado, on oak August 22, 1906.

Apterous viviparous female.—General colour cannot be determined. Antennæ light coloured throughout, legs slightly darker without black areas. Antennæ reaching slightly beyond the hind coxæ, third segment not as long as the fourth, fifth and sixth together. Third and fourth antennal segments without sensoria, fifth with one at the distal end. Beak reaching slightly beyond the hind coxæ. Abdomen with a row of distinct tubercles along each side, which are raised areas on the front edge of each tracheal opening. A few scattered glandular areas are also to be found on the abdomen. Each hind tibia has a number of round to oblong sensoria on the upper side of the basal one-third of the segment. It is possible that the specimens at hand are oviparous females, but it hardly seems possible that this form would occur in that climate as early as August. The cauda and oval plate are slightly distinct.

Measurements.— Length of body 3.5 mm.; width 2 mm. Length of antennal segments: III, 0.72 mm.; IV, 0.31 mm.; V, 0.4 mm.; VI, 0.25 mm. Total length 1.67 mm. Beak: III, 0.23 mm.; IV, 0.21 mm.; V, 0.083 mm.

Lachniella burrilli, new species.

From material collected by Professor A. C. Burrill on *Sabina scopulorum* at Twin Falls, Idaho, July 6, 1917. One alate specimen in good condition, one apterous specimen in poor condition and a number of larvæ. Mr. Burrill states that these were found on the underside of the limbs feeding on the bark, and that they greatly resembled the colour of the bark. Mr. Burrill's notes on coloration are included in the descriptions. Specimens of what is evidently the same species but differing slightly were sent to me from Fort Collins, Colorado, by Professor C. P. Gillette. These were collected on the same food plant. Types in writer's collection.

Apterous viviparous female.—General colour closely resembles the bark, being black with pruinose patches which produce a calico effect. Antennæ cream-coloured at the base and black at the tip. Abdomen with two rows of black blotches along the median line and two rows of black dots dorso-laterally along the abdomen. Legs with the femora black, and the tibiæ black at the tip. Nectaries black, cauda light coloured. Antennæ with third segment less than length of fourth, fifth and sixth segments. Fourth longer than the sixth. Third segment with three sensoria, fourth with one and five with one. Nectaries small conical, and diameter of base not much greater than that of the opening. Body, legs and antennæ moderately hairy, hairs short and inconspicuous.

Measurements.—Length of body 3 mm. Length of antennal segments: III, 0.42 mm.; IV, 0.2 mm.; V, 0.17 mm.; VI, 0.12 mm. Total length 1.3 mm.

Beak: III, 0.166 mm.; IV, 0.166 mm.; V, 0.063 mm. Total length 1.56 mm.? Length of hind tibiæ 0.95 mm.; hind tarsus 0.21 mm.

Alate viviparous female.—General colour black with white pruinose areas producing a calico effect. Antennæ cream-coloured at the base of the third and fourth segments, other parts dusky and tip dusky black. Head dusky, thorax black, wings dusky, veins with dusky borders. Legs with femora light coloured at base and dusky toward the tip. Tibiæ light coloured except slightly at the base and a small part toward the tip. Tarsi black. Abdomen smoky, with two rows of dorso-lateral black dots, and an extra dot on segment four. Posterior segments almost black. Cauda black. Third antennal segment shorter than the three distal segments, four and five approximately equal, and six shorter than four. Beak reaching to base of nectaries. Nectaries cone-shaped and rather large. Cauda and anal plate broadly rounded.

Measurements.—Length of body 2 mm. Length of antennal segments: III, 0.33 mm.; IV, 0.166 mm.; V, 0.18 mm.; VI, 0.1 mm. Total length 1.36 mm. Beak: III, 0.166 mm.; IV, 0.166 mm.; V, 0.083 mm. Total length 1.55 mm. Length of hind tibiæ 1.46 mm. Hind tarsus 0.23 mm.

Lachniella caudelli, new species.

From specimens collected by A. N. Caudell at Kaslo, B.C., July 7, 1903, on spruce. One slide containing one alate and five apterous forms. This species is sufficiently distinct to warrant a description, although the material at hand is not abundant. Types in U. S. Bureau of Entomology collection.

Apterous viviparous female.—General colour cannot be determined. Antennæ light at the base growing darker toward the tip, last segment dusky. First and second pair of legs light except at the joints, tarsi dusky. Hind legs with femora light at base and dusky towards the distal end; tibiæ dusky except a light area near the base. Tarsi dusky and long and slender.

Antennæ with third segment shorter than the fourth, fifth and sixth together. Fourth and sixth approximately equal in length. Third antennal segment without sensoria, fourth with one small, one or none and the fifth with one large one near the distal end. Beak reaching to base of nectaries. Nectaries with base quite flat and about three times as wide as the opening. Opening proportionately larger than the base. Abdomen with two irregular rows of black spots dorsolaterally placed, and with two rows of five oblong spots which appear to be glands. These spots are distinct on two individuals but their structure is obscured by the balsam. Cauda broadly rounded and anal plate wide and dished.

Measurements.—Length of body 2.42 mm. Length of antennal segments: III, 0.63 mm.; IV, 0.166 mm.; V, 0.25 mm.; VI, 0.19 mm. Total length 1.28 mm. Length of beak: III, 0.23 mm.; IV, 0.18 mm.; V, 0.1 mm. Total length 1.76 mm.

Alate viviparous female.—Antennæ dusky throughout and each segment of the same relative thickness. Third segment slightly longer than the fourth and fifth together, the fourth and sixth approximately equal. Third segment with five or six large sensoria, fourth with one or two and fifth with one very large, and one small sensoria.

The legs are generally dusky black with a slight yellowish area near the base of the hind tibiæ. Wings with the median vein having but a single fork.

Whether or not this is normal cannot be told until more specimens are gathered. Only one nectary is visible but it is distinctly shown. The base is a little wider than in the apterous forms, and is distinctly cone-shaped but with widely sloping sides. Hairs on antennæ medium short and not overly abundant; they are shorter on the legs but more abundant. They are fine and inclined backward.

Measurements.—Abdomen of this individual crushed, approximate length 2.5 mm.? Length of antennal segments: III, 0.47 mm.; IV, 0.21 mm.; V, 0.27 mm.; VI, 0.22 mm. Total length 1.32 mm. Length of beak: III, 0.21 mm.; IV, 0.167 mm.; V, 0.083 mm. Total length 1.6 mm.

Lachniella pinivora, new species.

From material collected by A. D. Hopkins No. 7422.

Two slides containing six alate specimens. This species resembles *L. gracilis* quite closely but there is considerable difference between the two, in that the hairs at the base of the tibiæ of *L. pinivora* are longer and more inclined than is the case with *L. gracilis*.

Alate viviparous female.—Antennæ light coloured at the base of the third, fourth and fifth antennal segments, distal portion of these segments and the sixth dusky. First and second pairs of legs yellowish at the base of the femora and along the middle of the tibiæ. Other parts and tarsi deep dusky brown. Hind femora yellow at the base and dark brown at the joint, hind tibiæ with yellow area clear and covering about one-third of the segment. Nectaries large and volcano-shaped. Cauda and anal plate both broadly rounded. Third antennal segment with seven medium-sized sensoria widely set apart, fourth with one or two and fifth with two. Third segment shorter than the last three together, five distinctly longer than four and six four-fifths as long as four. Beak short, extending to the farther edge of the middle coxæ. Hairs long and drooping, but not so much so as in *L. strobi*.

Measurements.—Length of body 2.9 mm. Length of antennal segments: III, 0.55 mm.; IV, 0.22 mm.; V, 0.24 mm.; VI, 0.164 mm. Beak: III, 0.172 mm.; IV, 0.15 mm.; VI, 0.63 mm. Total length 1.25 mm. Length of hind tibia 2.29 mm. Hind tarsus 0.27 mm.

Lachniella edulis, new species.

From material collected by Mr. L. C. Bragg at Trinidad, Colorado, June 18, 1911, on *Pinus edulis*. Other specimens collected on the same plant by Professor C. P. Gillette at Walsenburg, Colorado, and by Mr. Bethel, Cannon City, Colorado, may possibly be the same species although some differences have been noticed. Types in writer's collection.

Apterous viviparous female.—Antennæ clear at the base and dusky at the tip. Two anterior pairs of legs dusky except over a greater portion of the tibiæ. Hind legs dusky except a light coloured area near the base of the tibiæ. Third antennal segment slightly shorter than the fourth and fifth together; sixth segment about two thirds the length of the fourth. Apterous forms on Prof. Gillette's slide do not show sensoria on the third segment, while those collected by Mr. Bragg have three small ones near the distal end. Fourth segment with one or two and fifth with two sensoria. Nectaries large and volcano-shaped. Antennæ and body with a moderate number of medium short hairs, legs more abundantly set with short drooping hairs. Hind tibiæ distinctly curved.

Measurements.—Length of body 3.74 mm. Length of antennal segments: VII, 0.5 mm.; IV, 0.25 mm.; V, 0.27 mm.; VI, 0.145 mm. Total length 1.32 mm. Beak: III, 0.187 mm.; IV, 0.155 mm.; V, 0.063 mm. Total length 2.1 mm. Length of hind tibiæ 2.9 mm.; hind tarsus 0.33 mm.

Alate viviparous female.—Specimens cleared before mounting and colour characteristics not definite. Antennæ with third, fourth and fifth segments light at the base and dusky at the tip. First and second pair of legs with femora dark, tibiæ light coloured except at the ends. Hind legs with the femora and tibiæ dark except a yellowish area near the base. Third antennal segment slightly shorter than the fourth and fifth together, sixth segment little more than half as long as the fourth. Third segment with four to six round irregular sized sensoria, four with two or three and five with two. Wings folded under the specimens so that venation cannot be determined. Nectaries very large and volcano-shaped. Tibiæ long and strongly curved. Antennæ and body moderately set with medium short hairs, hind tibiæ, thickly set with short drooping hairs.

Measurements.—Length of body 3.5 mm. Length of antennal segments: III, 0.52 mm.; IV, 0.31 mm.; V, 0.31 mm.; VI, 0.187 mm. Total length 1.55 mm. Beak: III, 0.25 mm.; IV, 0.21 mm.; V, 0.063 mm. Total length 2.8 mm. Length of hind tibiæ 2.8 mm.; hind tarsus 0.35 mm.

Lachniella montanensis, new species.

From material sent to me by Mr. J. R. Parker, of the Montana Agricultural College. Two slides, one containing specimens collected by F. C. Bishop at Florence, Montana, July 2, 1914, on Pine and a second containing specimens collected by Mr. Parker at Bozeman, Montana, June 25, 1915, on *Pinus laricis*. Types in writer's collection.

Apterous viviparous female.—Antennæ with segments three, four and five yellowish at the base and dusky at the tip, sixth segment completely dusky. Legs completely black except a small section at the base of the femora and light areas near the base of the tibiæ. This area is a little longer on the front tibiæ. Nectaries dusky black broken with light patches about the base.

Third antennal segment longer than segments four and five together, fourth almost equal to five and six about one-half as long as four. Third segment without sensoria, fourth with one or two and fifth with three. Nectaries large and volcano-shaped, cauda angular. Antennæ and body moderately hairy, legs, abundantly set with short and drooping hairs. Hind legs strongly curved.

Measurements.—Length of body 4 mm. Length of antennal segments: III, 0.58 mm.; IV, 0.27 mm.; V, 0.27 mm.; VI, 0.15 mm. Total length 1.46 mm. Rostrum: III, 0.31 mm.; IV, 0.31 mm.; V, 0.1 mm. Total length 2.39 mm. Length of hind tibiæ 2.9 mm. Length of hind tarsus 0.27 mm.

Alate viviparous female.—Antennæ dusky to deep black with light areas at the base of third and fourth segments. Legs as in the apterous forms except that the light areas on the tibiæ are less prominent. Nectaries similar to those of the apterous forms. Third antennal segment approximately equal in length to the fourth and fifth segments together. The two latter being approximately equal in length to the fourth and fifth segments together. The two latter being approximately equal in length. Sixth segment about one-half as

long as four. Third segment with seven or eight regular and round sensoria whose diameter is about one-half the diameter of the segment. Fourth segment with two or three and five with two sensoria. Beak extending slightly beyond the hind coxæ. Wings typical of the genus.

Measurements.—Length of body 4 mm. Length of antennal segments: III, 0.6 mm.; IV, 0.29 mm.; V, 0.29 mm.; VI, 0.15 mm. Total length 1.48 mm. Rostrum: III, 0.31 mm.; IV, 0.30 mm.; V, 0.1 mm. Total length 2.4 mm. Length of hind tibiæ 2.9 mm.; hind tarsus 0.39 mm.

Lachniella schwarzii, new species.

From material collected by E. A. Schwarz at Prescott, Arizona, June 20, 1901, on *Pinus* sp. Also three specimens collected by Professor C. P. Gillette at Laporte, Colorado, July 1, 1898, on *Pinus ponderosa.* Types in U. S. Bureau of Entomology collection.

At a first glance this species may be taken for *Lachniella montanensis* as the markings of the legs and antennæ are quite alike and the wings, nectaries and cauda are very similar. The antennæ vary considerably, and the beak of *L. schwarzii* is much the longer in proportion to the length of the body.

Apterous viviparous female.—Antennæ light coloured over basal two-thirds of third and basal one-third of fourth and fifth segments, remaining parts and sixth segment dusky black. The three pairs of legs except the base of the femora and a yellowish area towards the base of the tibiæ dusky black. This light coloured area is much more extensive on the two front pairs than on the rear pair.

Third antennal segment equal to or slightly longer than the fourth and fifth segments together. Fifth segment slightly longer than fourth, and sixth about two-thirds as long as four. Third segment with one small sensoria at the distal end, fourth and fifth with two each. These are larger than the one on the third segment. Beak long, extending almost to or beyond the tip of the abdomen. Hairs on antennæ and body moderately abundant. Legs thickly set with short drooping hairs. Hind tibiæ strongly curved. Nectaries large and volcano-shaped. Cauda angular.

Measurements.—Length of body 2.5 mm. Length of antennal segments: III, 0.56 mm.; IV, 0.23 mm.; V, 0.26 mm.; VI, 0.166 mm.; IV, 0.23 mm.; V, 0.1 mm. Total length 2.49 mm. Length of hind tibiæ 2.45 mm.; hind tarsus 0.33 mm.

Alate viviparous female.—Colour markings of antennæ and legs like those of the apterous female except that the light areas on the tibiæ are not as extensive. Comparative length of antennal segments as in the apterous form. Third antennal segment with four to six round sensoria of irregular size, fourth with one or two and fifth with two. Rostrum long, reaching to or beyond the tip of the abdomen. Cornicles large and volcano-shaped, cauda angular.

Measurements.—Length of body 3 mm. Length of antennal segments: III, 0.51 mm.; IV, 0.23 mm.; V, 0.25 mm.; VI, 0.166 mm. Total length 1.3 mm. Rostrum: III, 0.25 mm.; IV, 0.22 mm.; V, 0.1 mm. Total length 2.9 mm. Hind tibiæ 2.49 mm.; hind tarsus 0.31 mm.

Lachniella pergandei, new species.

Description made from four slides selected from 25 as being representative of the different stages of the species.

Apterous viviparous female.—Specimens in balsam collected by Theo. Pergande, from *Pinus inops* in Virginia near Washington, D.C., June 9, 1903. The prominent character of this species is the deep brown to almost jet black tibiæ set with heavy leaning spines.

Antennæ medium slender and extending to the second pair of coxæ. All segments light coloured at the base, dusky toward the tip. Sixth segment fingerlike and approximately as long as the fourth. Fifth segment with three small sensoria toward the distal end. Beak short, reaching to the base of the third pair of coxæ. Tip dusky black.

Nectaries conical and with a widely sloping base. Cauda bluntly angled and short. Abdomen covered with irregular black spots, a hair arising from each one. The purpose of these spots has not been determined; outside these are found other hairs or bristles, the entire body being set with numerous long spinelike hairs.

The femora are brown in colour and the spines, which are not as coarse as those on the tibiæ, stand more nearly upright. The tibial spines are set in a leaning position pointing toward the tarsi.

Measurements.—Length of body 4.16 mm. Antennal segments: III, 0.52 mm.; IV, 0.29 mm.; V, 0.31 mm.; VI, 0.25 mm. Total length 1.52 mm. Length of beak 1.5 mm. Hind tibiæ 2.39 mm.

Alate viviparous female. Specimens in balsam collected by Theo. Pergande, on *Pinus inops*, Catholic University, D.C., June 19, 1905, and by H. F. Wilson at D. C. July 4, 1909. Three specimens in all. Antennæ dusky toward the tip, lighter at the base of the fourth segment and only the distal one-quarter of the third dusky. Legs with femora brown, tibiæ black. Beak black at the tip and extending slightly beyond the third pair of coxæ. Antennæel moderately slender and reaching to the hind coxæ. Segments four and five approximately equal. Fifth segment about three-fifths as long as the third, and much longer than the fourth or sixth. Third segment with six or eight round sensoria along the distal two-thirds. Fourth segment with two or three sensoria on the distal half. Nectaries as in apterous forms. Abdomen with numerous dusky spots each of which bears a spine-like hair as in the apterous form. Additional spines occur outside these areas. Entire body, legs and antennæ with numerous hairs.

Measurements.—Length of body 4.08 mm. Antennal segments: III, 0.56 mm.; IV, 0.27 mm.; V, 0.29 mm.; VI, 0.25 mm. Total length 1.55 mm. Length of hind tibiæ 2.33 mm.

(To be continued.)

BOOK NOTICE.

THE WINGS OF INSECTS.- By J. H. Comstock, Ithaca, N.Y., The Comstock Publication Company. Pp. XVIII + 423, 9 plates and 427 figs.

Among recent publications in the realm of entomological science few have given us more pleasure to read than Professor Comstock's work on the wings of insects, a pleasure that arises not only from the intrinsic value of an important series of investigations thoroughly prosecuted, but also from the assurance that

the subject is presented to us in logical fashion by a recognized authority. The terminology of the wing-veins of insects has always been a subject for debate, and the difficulties have not been diminished by the fact that at different times various authors have adopted systems of nomenclature that have taken little recognition of the work of others. Some authors, indeed, have not helped to unravel the skein by using different systems even when dealing with the same order of insects. It is a matter for congratulation, therefore, that Professor Comstock has found it possible to gather together and present in book form his numerous researches and those of other workers with a view to the adoption of a uniform terminology, the well-known Comstock-Needham system.

Commencing with what he considers as the most likely hypothetical type of wing-venation, the author traces out the homologies of the wing-veins and shows how the more specialized forms have arisen from the more generalized along three quite distinct lines; namely, 1. Increase in the number of wing-veins by the addition of accessory veins. 2. Increase in the number of wing-veins by the addition of intercalary veins. 3. Reduction in the number of wing-veins by the coalescence of veins, and also in many cases, by the atrophy of veins. In support of his theories Professor Comstock brings to bear information and facts laboriously gathered from the various provinces of palæontology, morphology, embryology and histology. In the first of these, judicious use is made of the careful work of Anton Handlirsch embodied in his "Die Fossilen Insekten und die Phylogenie der Rezenten Formen." Whilst on the whole Professor Comstock agrees with the views of the palæontologist, he differs with Handlirsch in his idea that all insects had a common ancestry in the Palæodictyoptera of Devonian times.

In a work that bears throughout the impress of the master-hand, it were invidious to make distinctions; but we must say that the chapter dealing with "The Basal Connections of the Tracheæ of the Wings of Insects," written by one of Professor Comstock's students, appeals to us particularly as a very careful piece of work. It is shown that there is a strict correlation between the tracheation of the wings of insects and the venation, although this fact is often obscured in the adult to accord with its needs and habits. In the study of the tracheation of the wings of nymphs and of pupæ the truth of the conclusion is demonstrated that the wings of all orders of insects are modifications of a single primitive type, and that consequently it is possible to homologise the wing-veins of any of the orders with those of any other order.

In a series of nineteen chapters Professor Comstock discusses in detail numerous types of venation as found in the various orders of insects, and a valuable chapter outlining laboratory work in the study of the venation of the wings of insects, enhances the value of the book as an aid to the teaching of the subject in universities and colleges. The student will also find an exhaustive bibliography of the more important works referred to in the text. The illustrations are excellent, and the explanatory letters very distinct.

Entomological Branch, Dept. of Agri., Ottawa, Ont. A. E. Cameron.

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POPULAR AND PRACTICAL ENTOMOLOGY.

Dog Days.

BY FRANCIS J. A. MORRIS, PETERBOROUGH, ONT.

Almanacs heliacal and cosmic notwithstanding, sunworshippers in Canada during the first fortnight of July, 1916, could hardly question the ascendancy of Sirius. The heat was so intense here, in Central Ontario, that tropical thunderstorms burst over the land every few days without ever lowering the mercury longer than a matter of hours. For certain forms of insect activity (we may safely say) it cannot be too hot, and at such times, if your observer is a real enthusiast, he will be more than busy. For my part I was enjoying the rest and leisure of summer holidays by hurrying at red-hot speed—a slow walk sufficed—to a succession of stations at four diverse radial points from the city of Peterborough, six miles east to the Wood of Desire, eight miles south to the neighborhood of Hiawatha, two miles west beyond Jackson's Park, and five miles north between Nassau and Lakefield. At the western station I was burrowing into the heart of a woodpile with results that have already been put on record. I wish here to say something of a trip I took towards Hiawatha.

On July 5th I boarded the early morning train to Keene, my object being to make a general reconnaisance of the country lying between Indian and Otonabee Rivers just north of Rice Lake; a solitary tramp one April, when wild geese were wedging north, had revealed some likely looking woods, and their promise had been confirmed by a motor ride to Hiawatha and a river trip to Jubilee Point. I started out determined not to show any more bias or discrimination than a man who is "sot" in his few peculiar ways can help, and that was why I carried field glasses and a pocket plant-press as well as insect net and collecting bottle.

On leaving Keene station, after a few uncertain questings like a hound at fault, I finally headed west, nose to the ground, and swung south at the second cross-road, in full cry for a compact-looking bush of hardwood and hemlock. Presently I came to where dense cedar aisles flanked the road on both sides. Experience had taught me to look in such places for some of the smaller *Botrychiums* (ferns), and I dived into the depths. As soon as I had had time to collect myself and look about, like some Indian pearl-gatherer, I found myself staring at a large clump of Macrae's Coral-root (*Corallorhiza striata*), still in bloom though 3 weeks later than usual; quite near it were some small plants of *Botrychium simplex*, while further on I found a few fairly large specimens of *Botrychium matricariæ* (*ramosum*). All this on the west side of the road; on the east this rare Coral-root was abundant, especially some feet down a steep bank on the outskirts of the wood I had been making for. It seems to have a decided preference for sheltered roadsides and the edges of woods, especially under evergreens; though one station at least that I know of is under hardwoods. The plant, usually known as Striped Coralroot, is a western species, and in Ontario is reputed quite as rare as, say, the Evening Grosbeak among birds; in the neighborhood of Peterborough, however, it is of fairly general occurrence.

and I have found about a score of colonies; it is in fact "locally rare," but we happen here to be a favoured district for the plant, as we are for the bird.

Once down the bank I found the adjoining wood so inviting that I stepped in and spent a couple of the morning hours wandering about in the shadows of its cloistered beech and maple. A footpath traversed the wood N. E. to a clearing partly filled with woodpiles, and close by the path I happened on several colonies of *Corallorhiza multiflora* just coming into bloom, and yet another "sicht for sair een" in the shape of *Habenaria hookeri*. For this plant I had only known a single station heretofore, a few miles north of Port Hope, and in recent years the colony had dwindled to 1 or 2 plants in a season. Here by Hiawatha I counted close on a score of plants; it is nowhere nearly so common an orchid as its next-of-kin *Habenaria orbiculata*.

From the shadows I emerged about 11 a.m. into the glare of the clearing and made a fairly thorough scrutiny of the woodpiles; there were no traces of longicorns about them, but buprestids (mostly *Dicerca divaricata*) in great numbers and astonishingly active in the fierce heat; almost as ready to take to flight on being approached as to play dead, an unusual condition for the species; two kinds of *Agrilus*, also, were to be seen about the piles and numbers of *Chrysobothris femorata;* however, these insects had all become common to me and I was free to pass on to further explorations. I could not but admire, however, the wonderful protective colouring which enabled these large, heavily built *Dicercas* to shuffle about over the grey bark of beech or maple almost unobserved and immune from attack; on a single small woodpile I counted upwards of 40 of these insects basking, crawling, or settling on the billets, and I brought 11 home to mark the occasion. My parting thought was how lucky I should have thought myself a few years before, as a young collector, to meet so fair a fortune face to face right on the threshold of the woods and a July holiday.

Next I made my way to a small grove of pines on a knoll beyond a soggy pasture; here were some bushes of sweetbriar and a patch of gowans from whose blossoms I gathered a few *Lepturas*, *pubera* and *proxima*, *Clytanthus ruricola* and *Typocerus lugubris*—an old friend now met again for the first time since leaving Port Hope.

I then crossed to the S. W. of the meadow, approaching the road along the edge of a wooded swamp. Right in the sun stood a large hemlock, its bark glowing red in the light, and immediately in front of it were some logs of hemlock lying; on one of the logs I spied an uncommon *Dicerca* with somewhat short-pronged elytra tips, noticeably stout across the back and remarkably rugose, the ridges dark grey, but the grooves and channels brilliant with a mixture of silver and rich green as of verdegris. Hardly had I captured the prize when a facsimile suddenly lit on the standing hemlock; but alas! as I approached over the rough, swampy ground, the insect flew and soaring in an upward plane was soon swallowed in space. Have you ever fed your spleen at the expense of some poor lumbering spaniel trying by a sudden dash to surprise a flock of sparrows feeding by the barn—for ever foiled, but never losing hope? I have, and smiled cynically at its comic look of dejection; but when cynic and hound are both in one skin, look you, the cream is off the joke. My capture has been identified as *Dicerca tenebrosa*,one of the most pleasing to look

at of all its genus and quite rare,—this being only the third specimen ever taken by me.

Just south of where I made these captures ran a good gravel road east and west; I struck west and after two miles entered a wayside smithy for directions; here they told me that the next cross-road would take me south to Hiawatha and north to the flag station of Drummond's. Both here at the blacksmith's and further on at a farm where I called for a drink of water, I was conscious of being eyed with suspicious looks, but since August, 1914, I had been taken for so many aliens that I gave the matter hardly a moment's thought.

To my delight I recognized at the next corner a piece of country near the Otonabee through which I had once motored, and I knew there was a fine stretch of woodland just S. W. of the cross-roads. It is always a great relief to swing out of the dusty highway with its cramped fence margins into the spaciousness of pasture and woodland.

The wood was too dense at this point for floral treasures, and proved after all a very narrow belt with the river in full view just beyond some stumplands. Just north-west the axe had been recently at work levelling part of a farmer's woodlot; there were stacks of cordwood visible, and a recent storm had taken heavy toll of timber on the newly exposed western edge. In the mid distance I spied a fallen spruce and a large limb of beech torn from its trunk. The day was at its height and no tiniest breath of wind invaded the throbbing heat. If ever there were insects abroad here in the day-time, it would be now.

My first venture was the fallen spruce, but nothing was to be seen about its rough, scaly bark, or among the branches and foliage. In falling, however, it had struck and heavily "blazed" a nearby balsam fir; this tree was languishing, for the foliage had gone brown. On examining the tree closely, I found just beside the grazed patch of bark (which was oozing resin freely) a fine specimen—a large female—of *Xylotrechus undulatus* ovipositing, and then, somewhat lower, a male of the same species; these beetles I had seldom taken before, and had indeed been uncertain as to which of our conifers it attacked. But I was able to make good use of my discovery, and secured later in the season over a score of the insects in the Algonquin Park. The other tree infested by it is the hemlock, and very rarely I have captured a specimen on spruce. Both these beetles were on the sunny side of the tree, and when I worked round to the shady side no more of their kind were to be seen; but I soon detected—courting the shadow as usual—a pair of *Acanthocinus obsoletus;* this was of some interest, for I had never before taken the species on any tree but white pine, where it is fairly frequent. Examination of several other balsams brought no fresh captures and I determined to move on towards the S. W., where fire had run between the belt of woodland and the river.

A path took me right past the broken limb of beech, part of which lay along the ground. Beech had never before brought me any captures of longicorns, and I was passing on with only a casual glance when I was stopped short by a discovery that proved the forerunner of many interesting captures during the dog-days of 1916. It was a small specimen of *Neoclytus erythrocephalus* that I spied running along one of the branches of the fallen limb. I suppose this insect is fairly common, a few specimens were once sent me from near the Rideau by an old friend who had noticed them racing over some fresh-cut

logs and branches of maple; about 4 years ago I captured 3 or 4 on some newly-lopped branches of hawthorn. But they are quite a difficult insect to capture; in my experience they are even more active than *Neoclytus muricatulus*, a black species with white or grey pubescence, occurring on white pine. So far as I have been able to observe (by a comparison of these two species of *Neoclytus* with *Xylotrechus undulatus* and *colonus*), the former have a far better title to the name *Xylotrechus* than the latter, which are much more sedate and leisurely in their movements; both species of *Neoclytus* are expert and habitual "log-runners," as the word *Xylotrechus* implies; they have extremely long hind legs and travel at a great rate, zig-zag or spiral, even leaping or dropping from one branch to another, by long odds one of the nimblest of our longicorns; in hot sun, they are quite as active on the wing as in running and dodging. Indeed, they are seldom at rest, except momentarily when breeding, or while ovipositing in shadow on the under side of the limbs and branches. In about half an hour I had captured 3 specimens and lost 2 more; I found that they soon returned, after escape by dropping or flight, to the log or limb of their choice. Besides these, on the broken trunk and upper part of the torn limb I captured an *Agrilus* that was new to me, 5 or 6 specimens,—*Agrilus obsoletoguttatus*.

About a quarter of a mile farther on I came across an old hollowed beech, which the same storm had broken off near the root; the tree had been partly dead before its fall and appeared to be even more attractive than the sounder wood of the torn limb. I captured 5 *Neoclytus erythrocephalus*, including a breeding pair which I detected perfectly motionless on the under side of a small branch; several more *Agrilus obsoletoguttatus* and 2 *Agrilus bilineatus*. These were all captured from above or the sides, on the branches and limbs; before leaving I stooped to look at the under side of the trunk which was a couple of feet up from the ground and parallel with it. I immediately became aware of a grey longicorn—indeed a pair—and by lying down under the tree I was enabled to make captures at several points on the lower surface; 4 *Urographis fasciatus*, 1 *Haplosia nubila* and 1 *Neoclytus colonus;* none of my readers, if interested in *Cerambycidæ*, will deny that this was reward enough for a certain discomfort of body; but, I have, sometimes, since, in atrabilious humour, pictured myself a middle-aged plumber of palpably inattenuate bulk, engaged in driving rivets up into the under side of many-jointed boilers and squat kitchen stoves.

On my way back to the road, I captured on raspberry foliage a specimen of *Oberea* having the thorax entirely light creamy brown, the body, legs, wings, and scutellum being black. This was the last of my captures that day, but the observations led eventually to quite a series of finds and really opened a fresh field of investigation for my tramps abroad.

The heat lasted on, and I managed a few days later to make a trip to the east section of the Wood of Desire, where beech trees are numerous; I figured on the storm which had taken toll so heavily near Hiawatha, having swept the west or windward side of that wood, and sure enough, I found nearly a dozen beeches down. On four of them, longicorns were busy; and on two that had come down together with roots intertwined, I captured 8 specimens of *Xylotrechus colonus* and 34 of *Urographis fasciatus*. Only trees in full sunshine seemed to be attractive, and the weather was unusually hot. I have examined beech assiduously all through July since 1916, and though I have made an

occasional capture, I have never taken insects in any great abundance. My experience has been very similar in the case of basswood, white pine, poplar, balsam and spruce; an occasional haul, but usually little or nothing; and even less on the harder wood of elm, maple, ash, butternut, hickory and oak. Theories are dangerous, but I incline to think that some sense of smell—probably sap or vegetable juices fermenting in the hot sun—releases the reproductive impulse in these woodborers and brings them in ever-growing numbers from all parts of a wood to the few windfalls that their instinct "senses" as the proper nursery of their race.

It was in piecing out such problems as these in the late afternoon of July 5th, 1916, in ruminating over the day's take, and in planning my next campaign, that I beguiled my way along the last few miles of this 12-hour jaunt. On arriving home I found that the weather man had recorded 98 degrees Fahr. in the shade, and when I caught sight of myself in the bathroom mirror I realized why I had been the object of so many suspicious looks. My face was tanned to the colour of a well-boiled lobster and smeared with muddy streaks that had once been summer dust; my tie had disappeared and my collar wilted to the form and semblance of a dirty handkerchief; the philosopher's dignity was further impaired by the revelation of a large, 3-cornered rent in one trouser leg. I was really lucky to have made my way home through more than a mile of populous city streets unarrested, if not unrecognized.

NATIONAL COLLECTION OF INSECTS.

Dr. J. McDunnough has been appointed Assistant Entomologist, in the Entomological Branch, Department of Agriculture, Ottawa, to have charge of the National Collection of Insects. Canadian Entomologists will welcome the return of Dr. McDunnough to his native country, and his appointment to a position in which he will be able to devote his extensive knowledge of systematic entomology to the care and building up of the National Collection.

AN ENTOMOLOGIST'S HANDBOOK.

An entomologist's handbook or compendium is very much needed, especially by economic entomologists. It is planned to compile such a handbook, which will include principles and methods of studying the life histories of insects, of conducting field experiments and demonstrations, handy tables for field workers, etc. It is desired to have references, or better, to have separates of all published notes dealing directly or indirectly with the subject and to have details, and if possible drawings or photographs as well, of cages, apparatus, methods, etc., as yet unpublished. The handbook will be a compilation and full credit given to all contributions.

The co-operation of entomologists is solicited.

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THE CYRTID GENERA THYLLIS AND MEGALYBUS.

BY F. R. COLE, BUREAU OF ENTOMOLOGY, FOREST GROVE, ORE.

The genus *Thyllis* was established by Dr. Erichson in a monograph of the Cyrtidæ published in 1840. Four species were described in this paper, all from Capeland, South Africa. In the year 1865 Dr. Philippi described six species of Cyrtidæ from Chile, for which he erected the genus *Megalybus*. In 1868 Schiner gave notes on two Chilean species in his "Reise der Novara," recognizing in these two forms two of the species described by Philippi a few years before. In this paper Schiner placed *Megalybus* as a synonym of Thyllis. In a note he stated that there was no doubt in his mind that the genera were the same, at least no character was given that would justify separation. In the two species before him he noted that the eyes met above and below the antennæ and he continues, "whether this is the case with all *Megalybus* species I cannot say, were it so, those *Megalybus* species in which the eyes do not come together under the antennæ would be in another genus, that would then differ from *Philopota* in the wing venation, from *Thyllis* by the eyes not joining under the antennæ."

In 1876 Westwood described four species from Chile, stating "the names here employed for this genus and its four species were found attached to the specimens in Mss. when purchased, and have been retained, although, I believe, they have never been published." Evidently Westwood had not seen Philippi's above mentioned paper, for all four species were synonyms of those described by Philippi and had perhaps been named from his collection. Neither did Westwood compare the genus *Megalybus* with *Thyllis*, to which it is so nearly related. In his generic description he states that the eyes are contiguous above and below the antennæ.

It would appear then that Schiner was correct in his synonym, but unfortunately *all* of the Chilean species of this group do not have the eyes touching beneath the insertion of the antennæ. My attention was called to this point when examining specimens of what I take to be *Megalybus gracilis* Phil. in the U. S. National Museum. There are three specimens collected in Chile by Mr. E. C. Reed. All have the eyes distinctly separated below the antennæ. Mr. J. R. Malloch informs me that all of his Chilean species of the genus *Megalybus* have the eyes separated below the antennæ. Verrall, in his "British Diptera," considers *Megalybus* as a distinct genus. It may be that one sex has the eyes contiguous below the antennæ and the other has not; if so, it is something occurring nowhere else in the family. It is my opinion that the genera should be considered as distinct, although they are very closely allied, as can be seen from the figures. The species of *Thyllis* which I have figured has two median dorsal ridges on the mesothorax, which are not present in the Chilean species of *Megalybus*.

There are five genera in the Cyrtidæ belonging to the remarkable group Philopotinæ, if we consider *Megalybus* as a genus, the others being *Thyllis*, *Philopota*, *Terphis* and *Helle*. They are distinguished from all other Diptera by the remarkable development of the prothoracic humeral lobes, which meet in front of the thorax in these forms. Most of the species have a grotesque, hump-backed appearance.

Some of the literature on the two genera under discussion is rather inaccessible and I give a translation of the descriptions below.

Thyllis Erichson.

"The proboscis has nearly the length of the body; it nearly but not quite reaches to the tip of the abdomen. The shield, lying at the base of the proboscis, projects somewhat in the form of a "Halbrinne." The antennæ are very small, the first joint exceedingly short, the second pear-shaped, the tip prolonged into a bristle. The pilose eyes are very large, contiguous in the middle line of the head, only that on the front arched side of the head there is a small triangular space for the face, a very small triangle on the vertex and also below the middle, island-like, a small rounded place, on the under side of which, but free from it, are placed the antennæ. On the somewhat raised vertex are three inconspicuous ocelli. Behind the eyes the head is considerably prolonged cylindrically. The head is moderately small. The thorax is convex, somewhat bowed or hunch-backed, the dorsal pieces of the prothorax are proportionately large, with the inner corners contiguous, and with the broadened anterior margin encroaching on the hind margin of the head. The separate segments of the abdomen are quite apparent. The wings have a complete submarginal cell, five incomplete posterior cells, of which the first takes in the tip of the wing, and two complete, long, slender discal cells. The body is thinly clothed with fine, short, recumbent, almost silk-like pile.

Cyrtus, under which genus (*Acrocera*) Fabricius and Wiedemann placed the one species described by them, is easily separated from these flies by the situation of the antennæ. It is more closely related, particularly in the structure of the thorax and the greatly developed prothorax, to *Philopota*. In venation it is intermediate between the two. In common with *Terphis* it has the eyes contiguous under the insertion of the antennæ."

The following is a translation of Erichson's descriptions of his four species.

Thyllis crassa.

Black, red mottled, anterior margin of prothorax, curved lateral mesothoracic stripes and marginal fasciæ of abdomen yellow, costal region of wings fuscous. Length 2½–3½ lines.

Acrocera crassa Fab., Syst. Ent., 332,2.

Cyrtus crassus Wied., Ausser. Zweifl. Ins., II, 15,4.

Body black, finely cinereous pubescent. Prothorax rufous, anterior margin yellow, lobes on both sides with a median black spot. Mesothoracic dorsum on both sides with a lateral curved yellow stripe bordered rufous, above scutellum twin reddish spots, posterior calli before scutellum with median testaceous stripe; pleura with a reddish spot before insertion of wings. Scutellum with an apical rufous fascia. Abdomen swollen, each segment reddish apically, apical fascia attenuated on both sides, interrupted in the middle, yellow. Legs rufous, fermora blackish, apex yellowish. Wings hyaline, costal vitta before apex marked fuscous. Squamæ hyaline.

Wiedemann described all the markings as yellow, Fabricius pointed out the presence of red at least on incisures of the abdomen.

Thyllis turgida.

Black, marked reddish, outer and posterior margin of prothorax, and lateral mark on mesothorax yellow, wings fuscous hyaline, toward the costa fuscous. Length 4 lines.

Body finely ashy pubescent. Thorax black and red marked, prothorax rufous, anterior and posterior margin yellow, lateral subarcuate obsolete vitta on dorsum of mesothorax and posterior calli before scutellum yellow. Scutellum all red. Abdomen swollen, first segment black, narrow apical margin yellow, the rest rufous, base of 2-4 fuscous, apex of 4-6 with yellow margin. Legs reddish brown, unspotted. Wings fuscous hyaline, costal vitta wholly brown. Squamæ hyaline.

Near the foregoing species but somewhat larger; the prothorax also has the hind margin yellow, the yellow band on the side of the mesodorsum is simply bowed, on the wings the light part is brownish, and the brown colour on the veins reaches to the tip; the femora are entirely red, and without yellow tips.

Thyllis obesa.

Black, anterior and posterior margin of prothorax, sides of mesothorax, scutellum and posterior part of abdominal segments yellowish, wings hyaline, fuscous toward costa. Length 4 lines.

Body finely ashy pubescent, black. Anterior and posterior margin of prothorax, dorsum of mesothorax on both sides with an arcuate marginal vitta and posterior calli before scutellum yellow. Scutellum black, yellow margined. Abdomen swollen, each segment above with terminal belt of yellow. Legs brown, femora from base to beyond middle black. Wings hyaline, costal strip fuscous, abbreviated before apex, rest of costa testaceous. Squamæ whitish hyaline.

In form similar to the two species above, somewhat more finely punctate and in colouring without a mixture of red, therein differing from *Th. crassa*, which also has the hind margin of the prothorax yellow and the lateral bands on dorsum of thorax are simply bowed. The yellow bands on abdomen are all of like size. The wings are coloured as in *Th. crassa*, the veins themselves are, however, not brown, as the bands lying back of them, but brownish yellow.

Thyllis compressa.

Black, thorax compressed, on both sides with a longitudinal brown vitta and a posterior brown spot, abdomen oblong, ferruginous, segments with basal bilobed black spots. Length 3 lines.

Head black, frons a small spot, brown. Thorax gibbous, compressed, above on both sides with a longitudinal stripe, from anterior margin thence gradually attenuated to base of scutellum, almost straight, reddish at termination, before scutellum two small spots, oblong, marked yellow, posterior calli before scutellum yellow vittate. Scutellum thick, bordered rufous, with a median apical yellow spot. Abdomen as the thorax much less highly arched (than usual), oblong, parallel sided, apex rounded, convex above, brown, segments with two dorsal black spots confluent at base, a small intermediate spot of yellow included, the lateral margin and venter all yellow. Legs yellow, femora brown, base fuscous. Wings all fusco-hyaline. Squamæ whitish hyaline.

In the laterally compressed form widely differing from the foregoing species, at first glance appears nearer a *Philopota*.

All four species are from Cape Land. The third is in the Drege collection, the others are from the material sent by Krebs.

Below is the description of a species of *Thyllis* loaned by Prof. A. L. Melander which may prove to be an undescribed species when more material is collected. It is near *T. compressa* Erich.

Thyllis, sp. near **compressa** Erich.

Head rather flat in front. Eyes short blackish pilose and meeting above and below the antennæ (see Figs. 2b and 2c). It will be noticed that there is a line between the eyes below the antennæ. Antennæ brownish, the small first joint scarcely visible. Ocellar tubercle very small and with three ocelli. The occiput is black and punctate. Frons reduced to a tiny triangular shining black space. Proboscis does not quite reach tip of abdomen, black at base, brown the rest of the distance, lobes at tip of galea rather short.

Thorax black, marked with yellow and red, the pile rather short, fine and ashy coloured. There is a very noticeable ridge each side of the median line of the dorsum (see fig. 2a). The prothorax is very remarkably developed as in others of the group and is mostly pale yellow. It is butterfly-shaped as seen from above, marked with reddish brown on the lateral margins, and on either side of a median black spot. There is a yellow crescent rimmed with brown above the base of the wing and a smaller spot just back of it. Two oval yellow spots just in front of scutellum. Postalar calli pale mottled brownish, black in the depression just back of the wing. Scutellum black with yellow margin, the yellow expanded in the middle. Pleura black with a reddish brown spot on mesopleura. Halteres yellow.

Abdomen rather short and thick. First segment very short. Segments 2–5 increasing slightly in length, the incisures deep and clearly marked. Second segment broadest, the following gradually decreasing. Colour of abdomen mostly brownish red, all segments except sixth black basally. A median line of yellow spots on the posterior border of each segment, the yellow surrounded by a brownish red which nearly reaches the base of the segment. Lateral margin of abdomen narrowly whitish yellow as in the margin of the fifth segment. Venter yellowish. Squamæ whitish hyaline with a sparse fringe of short hairs. Very little of genitalia projecting in the female.

Coxæ and bases of femora blackish. Tibiæ, tarsi, tips and part of underside of femora yellow. Claws black, yellow at base. Venation typical of genus. Wing veins on anterior half of wing strong and blackish. Veins from posterior cells do not reach posterior margin of wing. Wing membrane strongly rippled, infuscated, darker in costal region. Length 5 mm, measured over dorsum of thorax 7mm.

One female specimen from Willowmore, Capetown, S. Africa, collected by Dr. Brauns. Specimen in collection of Prof. A. L. Melander.

Below is given a translation of Philippi's description of the genus *Megalybus* and its six species published at Vienna in 1865 in the K. K. Zool. bot. gesellsch. Verhandl., V, 15, p. 641–644.

The head is very strongly bowed (geneigt), rounded, composed almost entirely of the eyes, behind which a very prominent ring-like occiput is to be seen, that is, however, smaller than the front part of the head. The eyes are dark brown and pilose. The small ocellar triangle shows the usual three ocelli. In the middle of the height of the head when one sees it in profile, projects a small, smooth knob between the eyes, and under this are situated the small

apparently two-jointed antennæ, whose first two joints combined are hardly twice as long as this knob; the second (actually the third) is rounded and ends in a fine bristle. The proboscis is long, pointing back under the body, split at the end into two thread-like lips, which are somewhat curled up. The palpi are (as in *M. pictus*) very small, awl-shaped, horizontal. The thorax is as large as the abdomen, extraordinarily gibbous, that is, the mesothorax is raised high so that the abdomen forms a right angle with the forepart of the thorax; prothorax, mesothorax and metathorax are clearly separated by sutures.—The abdomen is cylindrical, thick or slender, six-segmented, but the first segment is very short; all segments separated by deep incisures.—The wing venation is nearest *Cyrtus*, but it is characteristic, namely the cell which takes in the tip of the wing is not petiolate as in *Cyrtus*. The squamæ are convex, thick, glass-like. The legs are simple; the tibiæ somewhat thickened at the end, entirely unarmed, the claws large, there are two "Haftlappen."

"The adult insect is found on flowers; the larvæ live, it would seem in wood, at least my son Karl, in Dec. 1863, found a fly of this genus just crawling out of a tree.

"1. *Megalybus pictus* Ph. M. niger, helvolo-pictus, antennis capitesque nigris, rostro helvolo; thorace vittis interruptis helvolis notato; abdomine crasso, maculis ternis triangularibus helvolis in quovis segmento picto; alis ante apicem fascia abbreviata nigra ornatis; femoribus nigris, genubus, tibiis tarsisque flavis. Length 3 lines, expanse of wings 5½ lines.

"Habitat in the province of Santiago.

"The prothorax is clearly differentiated, black, rimmed light yellow, has a short furrow in the middle, and its hind margin forms two corners. The mesothorax is of great height, has on the fore part four short, light yellow stripes, of which the side ones are strongly curved, and as many shorter stripes in the posterior part. The hind margin of the scutellum is yellow. On each side of the scutellum is a yellow dot between the edge of the mesothorax and the glass-like squamæ.

"2. *M. crassus* Ph. M. thorace maxime gibboso, rufo, strigis helvolis et castaneis picto; abdomine crasso, supra nigro-castaneo, et in medio marginis postici segmentorum macula parva triangulari flava notato, lateribus potius, ferrugineo, marginibus flavescentibus, alis hyalinis fusco-bimaculatis; pedibus e ferrugineo luteis. Length 3 1/3 lines, expanse of wings 8½ lines. (See figure).

"Captured in province of Valdivia.

"The head is brownish, the proboscis reaches three-fourths the length of the body. The antennæ are light brown and the prominence above them white. The prothorax is light rust brown with whitish yellow margins; the mesothorax is of the same ground colour and marked with the same whitish yellow stripes as *M. pictus*, but in the middle is deep chestnut-brown, and is highly arched in a very remarkable manner. The scutellum is dark chestnut brown, with whitish yellow margins. Also the abdomen is dark chestnut brown, with small triangular whitish yellow spots on the middle of the posterior margin of the second, third, fourth and fifth segments, on the sides rust brown with pale yellow margins. The wings have a blackish cross-band shortly before the tip, which reaches to the anterior margin, but ceases some distance from the posterior

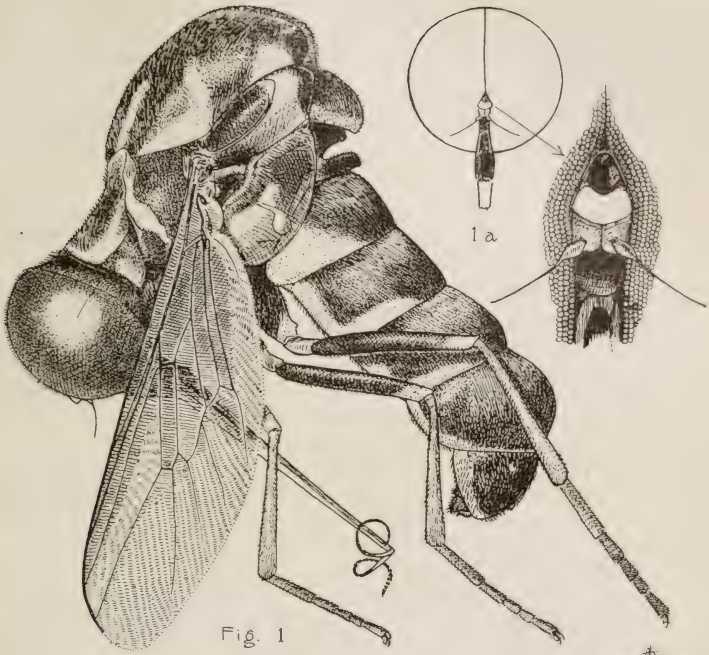

Fig. 1

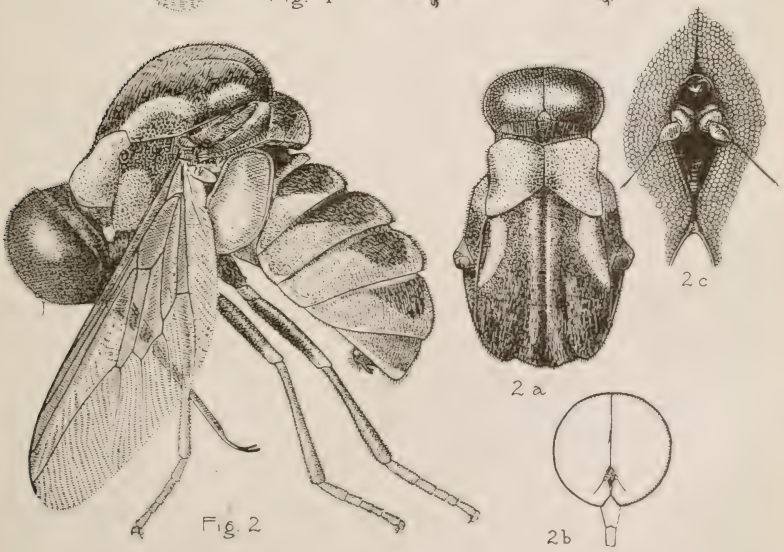

Fig. 2

THE CYRTID GENERA THYLLIS AND MEGALYBUS.

margin, and a blackish cloud in the middle. The legs are entirely yellow, and the femora hardly noticeably darker.

"3. *M. obesus* Ph. M. rufo-castaneus; antennisque nigris; thorace vittis tribus nigris, maculisque sex helvolis picto; abdomine crasso, ad medium marginum posticorum segmentorum macula parva helvola notato, ad latera immaculato; alis fusco-bimaculatis; pedibus rufo-fuscis, femoribus piceis. Length 3¼ lines, expanse of wings almost 9 lines.

"Specimen prope Corral æstate 186¾ lectum est.

"The proboscis is yellowish, the frontal prominence over the antennæ yellowish white. Of the spots on the thorax two are before the scutellum, another on either side before the base of the wing, and one on each side before the end of the scutellum. The fifth abdominal segment has a narrow yellow posterior margin, which coalesces with the yellow spot in the middle of the same. The abdomen is dull, the base of all the segments is clothed with fine reclinate hair, which gives the effect, that they shimmer gray in certain lights. This is the thickest and largest species and separated from *M. crassus* through the lack of yellow colour on the sides of the margins of the abdominal segments. By closer observation the whole colouring is seen to be quite different.

"4. *M. gracilis* Ph. M. corpore obscure brunneo; thorace quam maxime gibboso, flavo-picto; abdominis tenuis, cylindrici, apici incrassati segmentis lateribus helvolo-marginatis; pedum luteorum femoribus supra fuscescentibus; alis infuscatis, immaculatis. Length 3½ lines, Expanse of wings 7 lines.

"Inhabiting the province of Valdivia.

"The dark brown eyes are white pilose, the antennæ brown, the frontal protuberance above the same whitish yellow, the light yellow proboscis is hardly half as long as the body. The thorax is brown, clothed with yellowish hair in front and ornamented with pale yellow marks. The prothorax has a yellow margin, the mesothorax is marked with four short yellow stripes above, with two short yellow stripes above the scutellum and a yellow stripe on each side, which commences back of the base of the wing. The scutellum is unmarked above, brown, but the underside is yellowish. The abdomen is very thin, cylindrical, thickened posteriorly; the second segment is as long as wide, smaller posteriorly, the third segment at least 1½ times as long as broad, the fourth similar, the fifth of the same length, but thickened posteriorly, the sixth segment is small, directed downward, not visible from above. The colour on the dorsum is dark brown, on the side each segment has a yellow spot, becoming broader posteriorly; the fourth and fifth have above in the middle of the posterior margin a small yellow spot, which on the fifth segment coalesces with the (also yellow) hind margin. The venter is yellowish. The wings are infuscated, brownish gray, unspotted.

"5. *M. tristis* Ph. M. corpore nigro, sub-unicolore; thorace minus gibboso, flavo-punctato; abdominis gracilis segmento primo lateribus, tertio in margine postico flavis; pedibus ferrugineis, femoribus atris, basi tibiarum nigricante; alis infuscatis, nubecula centrali obscuriore. Length of body 3½ lines, expanse of wings 6 lines.

"Taken in my Valdivian estate at San Juan, of which I have frequently spoken.

"The yellow proboscis is about half as long as the body or only a little

longer. The thorax is back and lacks the yellow stripes. Also the prothorax has no yellow margin, and only the raised edges, which separate the middle from the side parts of the same, have in their posterior region a yellow colouring. The Mesothorax is almost always very strongly arched but not so unusually as in *M. gracilis* or *M. crassus*. Over the base of the wing on either side is a small circular, yellow spot, and four of the same on the posterior margin before the scutellum, of which the outer are the larger. Also the downwardly directed tip of the scutellum is yellowish. The abdomen is of the same slender form as in the preceding species, but entirely black with the exception of the narrow posterior margin of the fifth segment, which is yellow; on the third and fourth segment only the lower half of the posterior margin is yellow, and on the second segment is likewise furnished with a yellow posterior margin. The legs are in general dark brown, the tibiæ lighter, the femora deep black, at the lower end with a yellow ring; also the ends of the tibiæ are yellowish. The wings are infuscated and have a dark cloud in the middle. At first glance one could take this species to be a colour variety of *M. gracilis*, but the height of the thorax is very different, etc.

"6. *M. subcylindricus* Ph. M. niger, margine prothoracis, vittis interruptis mesothoracis, margine posteriore lateribusque segmentorum abdominis cylindrici, crassiusculi flavis; alis infumatis; pedibus luteo-ferrugineis, femoribus nigris. Length of body 2¾ lines, expanse of wings 4½ lines.

"One specimen taken with the previous species.

"The head is black, frontal protuberance and proboscis yellow. The prothorax has a yellow hind margin and now and then the anterior margin is yellowish brown. The mesothorax is highly arched for this genus, somewhat as in *M. tristis*, and has in front four abbreviated yellow stripes and four similar stripes posteriorly. The margin of the scutellum and the sides of the mesothorax are yellow. The abdomen is not nearly so slender as in *M. gracilis* and *tristis*, but much thinner than in *M. pictus* and *crassus;* the first segment is clearly visible, the second broader than the following, but the same length as these, the third, fourth and fifth are apparently as broad as long. The sides and posterior margins of these segments yellow and the margins have a yellow spot in the form of a triangle in the median section of the dorsum. The wings are infuscated, unspotted, yet a darker cloud can be made out in the middle. The legs are dark as in *M. tristis*.

Through the kindness of Mr. F. Knab I obtained the loan of three specimens of a species of *Megalybus* from Chile which I have mentioned in the first part of this paper. They are probably *M. gracilis* Phil. and I give a description below:

Head black, occiput ring-like and with a rim next to the prothorax (see fig. 1). The occiput is finely punctate and with fine white pile. Eyes with fine, short white pile, the facets very small. Ocellar tubercle triangular and raised only slightly. The head appears round from in front and more than a hemisphere viewed in profile. The small triangular frons projects somewhat and is black at the base, the lower half being ivory white. The antennæ are small, yellowish brown, contiguous at the base, the first joint scarcely visible, the third ending in the usual bristle. The eyes are separated below the antennæ by almost the width of the frons at the widest part (see fig. 1a). The proboscis reaches almost to the tip of the abdomen, brownish at the base, otherwise yellowish, and ends

in two long slender lobes which are curled up and give the appearance of being jointed beyond the middle. (See fig. 1).

Prothorax remarkably developed as in others of the group, dull black, finely punctate, and with yellow margins. The thorax is of like colour and texture, short shining white pilose posteriorly and laterally, the rest brownish pilose. Two widely separated, short yellow lines on the anterior mesonotum, and a yellow curved mark outside these on the lateral margin. Two oval yellow spots in front of the scutellum, and a yellow spot above the postalar callosities which runs down across them. Scutellum black with a yellow hind margin. Pleuræ black with a yellow mark in front of the wing.

Abdomen black, the lateral margins yellow, broadly on the second, the yellow reaching across on posterior margins of segments some distance. First segment very short. On the dorsal margin of the second, third and fourth are small median yellow triangles. The sixth segment is black with a yellow margin. Squamæ with narrow margin and almost transparent membrane. The pile on the abdomen is rather short, recumbent and shining in certain lights.

Legs yellow, femora blackish brown, pale beneath, the base and tips yellow. Tibiæ and tarsi yellowish brown. Wing venation typical, the membrane strongly rippled and infuscated light brown.

Explanation of Plate II.

Fig. 1. *Megalybus gracilis* Ph.
- 1a. Outline drawing of head from front and greatly enlarged figure of frons and the region around it.

Fig. 2. *Thyllis compressa?* Erich.
- 2a. Head and thorax from above.
- 2b. Outline of head fron front.
- 2c. Drawing showing eyes meeting above and below the insertion of the antennæ.

AN APPEAL FROM BELGIUM.

The following letter has been received from the Curator of the Entomological Section of the Royal Museum of Natural History of Belgium:

Translation.

Brussels, 11–1–1919.

Dear Sir:

It is absolutely necessary that you write some notices in the American scientific journals in order to save the Selys Catalogue. I have lost twenty subscriptions in Europe and I must retrieve them in the United States. Financial aid from the de Selys family is impossible for a long time. Each new subscription will bring a little capital to the reconstitution of this work which can be brought to a termination with a little energy and with the aid of all. The great institutions, libraries, etc., ought to put some of their pennies into subscriptions. . . . .

Here we have suffered much from the slow and inexorable hunger, from the nervous depression of our abominable slavery that no one can describe. Our museum and our collections are saved, but I have lost one of my two sons who was at the front, a fine boy of 24 years, a captain of engineers. I have lost a part of my small fortune and my health, but more I fear that the sufferings from hunger have compromised the future of my younger son and of my grandchildren.

The balance sheet is sad, and I have little courage to take it up. I would not, however, see the Catalogue, to which I have devoted myself for years, founder. This is why I call for your aid. Write to your entomological friends and sustain me,

Yours sorrowfully,

G. Severin.

The Baron Edmond de Selys Longchamps (1813–1900) was known as the chief authority on the taxonomy and geographical distribution of the Odonata. He formed an extensive collection of these insects and of other "neuropteroids" from all parts of the world, and of the vertebrates and some other groups of Europe. These collections were presented, after his death, to the Brussels Museum by his two sons.

The publication of the *Catalogue Systematique et Descriptif des Collections Zoologiques du Baron Edm. de Selys Longchamps*, "designed to realize the supreme desire of their late possessor and at the same time to serve science," was begun in 1906 under the care of the two sons, M. Severin and a number of zoologists, who interlook, as specialists, the preparation of certain parts thereof.

It was planned to appear in 32 fascicules of a varying number of pages, of large quarto size, illustrated by text figures and some plates. The subscription price for the complete work was fixed at 25 centimes (20 centimes for the fascicules on Orthoptera, Lepidoptera and Vertebrata) per page of text, 2.75 francs per coloured plate and 2 francs per black and white plate, with an increase of 25 per cent. for subscriptions to separate parts only.

At the beginning of the war 21 fascicules had appeared, treating of the Orthoptera, Embiidæ, Perlodides, Megaloptera, Trichoptera, Ascalaphidæ, Libellulinæ, Cordulinæ, Aeschninæ, Birds, Mammals, Amphibia and Fishes, at a total price of 703.50 francs. The eight fascicules on the Libellulinæ by Dr. F. Ris, of Rheinau, Switzerland, constitute the most extensive monograph on that subfamily ever produced, and several other groups have been dealt with a similar fashion. Several fascicules are in such an advanced state of preparation or of printing that they can be issued in a short time.

There are many reasons—scientific, humanitarian, international, appreciative of the nation which has suffered so fearfully—why the Selysian catalogue should be carried to completion, and it is to be hoped that readers of this appeal will personally do all in their power to aid in this accomplishment by inducing institutions which they can influence to subscribe. All correspondence relating to subscriptions should be addressed to M. G. Severin, Musee Royal d'Histoire Naturelle, 31 Rue Vautier, Bruxelles, Belgium.

Philip P. Calvert,
University of Pennsylvania.

THE DIPTEROUS GENUS IMITOMYIA TNS. (HIMANTOSTOMA LW.).

BY J. M. ALDRICH, U. S. DEPARTMENT OF AGRICULTURE, BUREAU OF ENTOMOLOGY.

Loew described *Himantostoma sugens* as number 87 of his Fourth Century of N. A. Diptera, in Berliner Ent. Zeitschrift for 1863. He appended a note describing the genus as new also; it contained but the one species, based on a single male specimen, the locality being given as Illinois.

Until recent years this genus remained an enigma to dipterists. Coquillett in his Revision of N. A. Tachinidæ, 1897, 40, mentions it among those unknown to him. Adams, in Williston's Manual, 1908, 377, lists it among those which he cannot place in his table. Townsend, however, states in his Taxonomy of the Muscoidean Flies, 1908, 126, that he has seen the type; without further comment he places it in his tribe Clistomorphini, family Phasiidæ. Later (Proc. Ent. Soc. Wash., XIV, 49, 1912) he proposes Imitomyia to replace Himantostoma, which is preoccupied by Agassiz in Coelenterata in 1862; this time he refers the genus without comment to tribe Eutherini, subfamily Pseudodexiinæ, family Exoristidæ.

In 1915 Harrison E. Smith published the new genus and species, *Saskatchewania canadensis* (Can. Ent., XLVII, 153), based on two males and four females taken at Farwell Creek, Saskatchewan. A few months later when visiting me he stated that Dr. Townsend believed this to be the long-lost *Himantostoma sugens*.

On June 18, 1918, I collected thirteen females of *sugens* at Minot, N.D., on flowers of ox-eye daisy growing in low ground (slough or hay land among small timber) near the Mouse River just above the city. One of these I later sent to Nathan Banks at the Museum of Comparative Zoology, who compared it with the type of *sugens* and pronounced it the same species. My material exactly fits Mr. Smith's excellent description of *Saskatchewania canadensis*, and was taken about 60 miles from the southeast corner of Saskatchewan.

Since the species has been rediscovered in the northern plains region, it would appear quite likely that the original specimen came from there also. Osten Sacken received much material from Robert Kennicott (see his Record of My Life Work, p. 35), who collected in Illinois as well as in the far north for him; so there was an opportunity for error before the specimens reached Osten Sacken.

In 1897 Thalhammar (Termesz. Füzetek, XX, 145) described a *Himantostoma hungarica* from Hungary. Bezzi in the Palæarctic Catalogue made this a synonym of *Ancistrophora mikii* Schiner.

The genus was described by Professor Bezzi in Boll. de Lab. Zool. Portici, XII, 86-93, 1917. Here he recognizes *hungarica* as a valid species of *Himantostoma*, and describes a species from North Africa as *H. mochii*. In receiving this paper from the author in 1918, I sent him a specimen of the type species *sugens*, and he has since informed me that neither of the old-world species is congeneric; *hungarica* he puts back as it was in his catalogue, and has proposed a new genus for *mochii*, which is still I believe unpublished.

A new description of the genus and species is unnecessary, since Mr. Smith has given a complete one which is readily accessible. I will add, however, that in the table in Coquillett's revision Imitomyia will come out at couplet 6, page 30, where it separates by possessing a long, slender proboscis and very striking flat facial carina; and in Adams's table it runs to couplet 10, p. 361, where it separates on the same characters.

March, 1919

SOME NEW OR SCARCE COLEOPTERA FROM WESTERN AND SOUTHERN FLORIDA.—III.

BY W. S. BLATCHLEY, INDIANAPOLIS, IND.

(Continued from p. 32.)

Molorchus semiustus Newm. —One specimen taken by beating in Skinners' Hammock, March 9. Usually classed as a variety of *bimaculatus* Say, but aside from the nearly uniform reddish-brown hue, it is stouter, with broader more depressed thorax, the sides of which are less rounded and disk without the smooth callosities present in *bimaculatus*. It has previously been known only from St. John's Bluff and Crescent City, Fla.

Neoclytus erythrocephalus Fabr.—One specimen taken at same place as the two preceding, Feb. 16. Schwarz (Ms.) notes its occurrence at Enterprize and Crescent City.

Leptostylus parvus Lec.—One taken at light in house at Lakeland, Feb 22. Schwarz (Ms.) records it from Lake Worth and Key West.

Labidomera clivicollis Kirby.—I was surprised to find this large, well-known Chrysomelid not listed from Florida. Two specimens were beaten from bunches of dead leaves, where they were hibernating, in February at Skinner's Hammock.

Galerucella nymphææ Linn.—This is usually supposed to be a species of strictly northern distribution. Five specimens were obtained from the flowers of the yellow water-lily, *Nymphæa advena* Sol., near Moore Haven, Fla., on March 2. It is possible that the species may have been introduced near there from Northern Europe, where it is said to be common.

Disonycha leptolineata Blatch.—Farther examination of 30 or more specimens taken during the past two winters leads me to believe this distinct and not a variety of *D. abbreviata* as described.* It occurs on ferns in Skinner's Hammock in February and March, and has also been found at Lakeland and Lake Istokpoga.

Longitarsus fuscicornis, sp. nov.—Oblong-oval. Shorter and more convex than *L. testaceus* Lec. Pale brownish yellow, not alutaceous, head and hind femora slightly darker; elytra with a vague darker, W-shaped, scutellar blotch; antennæ fuscous, the four basal joints pale; under surface dusky brown. Antennæ rather stout, two-thirds as long as body, the second, third and fourth joints subequal in length, shorter than those which follow. Thorax slightly wider than long, sides feebly curved, rounded into base, disk very minutely and sparsely punctate. Elytra one-third wider at base than thorax, rather strongly convex, umbones evident but small, punctures of disk very fine, almost invisible. Wings present. Length 1.3–1.5 mm.

Described from four specimens swept from low vegetation about ponds near Dunedin, Oct. 26–Dec. 13. Differs from both *testaceus* and *cotula*, our other species of similar hue, by the fuscous antennæ and the lack of the greasy aspect which they have, due to their alutaceous surface. The form is comparatively more robust than in either, and the punctuation finer.

Longitarsis solidaginis Horn.—Two specimens taken by sweeping north of Dunedin, March 20 and 25. Known only from Sumter and Orange Counties, Florida.

*Can. Ent., 1917, 143.

Chætocnema cribrifrons Lec.—Taken at Dunedin by sweeping in February. Horn gives its distribution as Colorado, Texas, Dakota, Georgia and California.* This is the first record for Florida.

Epitrix parvula Fab.—Horn says of this species: "Occurs throughout the entire U. S. extending also to the West India Islands." It has not been reported from Florida. A specimen was taken by sweeping on Hog Island, March 26.

Bruchus coryphæ Oliv.—One specimen beaten from a mass of Spanish moss near Dunedin, Dec. 23. No previous published record for the State. Schwarz (Ms.) notes its occurrence at St. Augustine and Haw Creek.

Bruchus cruentatus Horn.—Hibernates like the preceding in bunches of Spanish moss. Quite frequent near margins of lakes at Lakeland, Feb. 22, and also taken at Dunedin on several occasions, Nov. to March. Recorded only from Tampa. The hind legs of Florida specimens are more often red than black. The form with red spots absent, *nigrinus* Horn, also occurs near Dunedin, but only two specimens have been found.

Bruchus macrocerus Horn.—This species, known heretofore only from New Jersey, Tennessee and District of Columbia, occurs also near Dunedin, three specimens having been taken in March while sweeping huckleberry and other low shrubs.

Bruchus compressicornis Schæff.—Frequent at Dunedin; also taken at Ormond and Sanford. Occurs on flowers of the frost-weed, *Helianthemum corymbosum* Michx., in March and April. Described from Brownsville, Texas, and not elsewhere recorded.

Strongylium anthrax Sz.—Described from Enterprise, and noted by Schwarz (Ms.) as occurring at St. Augustine. One specimen taken at porch light at Dunedin, Aug. 6.

* * *

The family Cistelidæ is especially well represented in western Florida. Five species from there have been described by the writer in previous papers, and at least half a dozen which cannot be placed by the literature extant are at hand. Examples of all species taken were recently sent to Col. Casey, who monographed the family some years ago.** He states that a number of them are unknown to him. Notes on several of the species and descriptions of three which are undoubtedly new are herewith given as follows:

Hymenorus difficilis Casey.—Two specimens, so pronounced by Casey, are from Ormond and Dunedin. They were taken in April by beating. His type was from New York.

Hymenorus dichrous, sp. nov.—Elongate-oval, large for the genus. Nearly uniform dark brown, shining; head and thorax often slightly darker; elytra with basal third more or less tinged with dull red; antennæ, palpi and legs pale reddish brown. Head small, coarsely and sparsely punctate between the eyes which are very large, coarsely faceted, separated by about their own width (female), almost contiguous (male); clypeus, and occiput behind the constriction, coarsely and densely punctate. Antennæ short, stout, the apex of eighth joint reaching base of thorax, the third and following joints subequal in length, the second only one-fourth the length of third. Thorax one-third wider than

*Trans. Amer. Ent. Soc., XVI, 1889, 261.
**Ann. N. Y. Acad. Sci. VI, 1891, 69–170.

long, sides straight from base to beyond middle, thence rounded into apex, hind angles rectangular; disk rather closely, not coarsely aciculately punctate, the punctures separated by nearly their own diameters. Elytra scarcely wider at base than thorax, sides parallel for two-thirds their length, then converging and rounding to the obtuse apex; striæ very fine, their punctures small, round, close-set; intervals flat, each with two rows of minute punctures, each puncture bearing a rather long, strongly inclined, pale brown hair. Abdominal segments 1–3 finely and sparsely punctate, four and five almost smooth.

Length 6.7–7.2 mm.

Described from nine specimens taken at Sanford and Dunedin, Fla., March 29–Oct. 31, mostly by beating, some at porch light. In colour resembles *dorsalis* Sz., but larger, broader, less parallel, with shorter antennæ and more sparsely punctate thorax, the red hue of elytra less distinct. In *dorsalis* the eyes are as widely separated in male as in female, the back portion of occiput is sparsely punctate, the middle of seventh joint of antennæ reaches base of thorax, and the punctures of elytral intervals are much more distinct than in *dichrous*.

Hymenorus sabalensis, sp. nov.—Elongate-oblong, smaller and more slender than *dichrous*. Head, thorax, antennæ and basal third of elytra dull red, legs paler; apical two-thirds of elytra dark brown. Head rather large; interocular area and clypeus coarsely and very sparsely punctate; eyes separated by one-half their width. Antennæ rather stout, half the length of body, the third joint two-thirds the length of fourth. Thorax one-half wider than long; sides evenly and broadly curved from basal third to apex; disk vaguely and broadly impressed each side on basal third, its surface sparsely and rather finely punctate, the punctures separated by twice or more their own diameters. Elytra at base slightly wider than thorax; striæ fine, their punctures small, close-set; intervals slightly convex, each with two rows of punctures which are almost as large as those of striæ. Under surface dull red, the abdomen punctate as in *dichrous*, the prosternum more densely so. Length 6 mm.

One specimen taken by beating palmetto leaves on Hog Island, March 22. Distinct by its peculiar coloration and widely spaced punctures of thorax.

Hymenorus sobrinus Casey.—One specimen, so determined by Casey, taken at Lakeland, Feb. 22, by beating masses of Spanish moss. The species was described from Florida without definite locality.

Andrimus brunneus Casey.—Frequent at Dunedin and La Belle in February and March. Taken by sweeping, and, in late March, at porch-light. Described from Haulover, Florida.

Andrimus parvulus, sp. nov.—Elongate-oblong. Pale chestnut-brown, shining; legs and palpi paler. Head small, with a wide groove between the eyes; clypeus and occiput finely and densely punctate. Eyes large, coarsely granulate, separated by a distance one-third greater than their width. Antennæ stout, joints 4–11 flattened, 2 and 3 together only one-third the length of fourth. Thorax subquadrate, slightly wider than long, base squarely truncate, front and hind angles rounded; disk minutely alutaceous, very finely and sparsely punctate, without trace of basal foveæ. Elytra one-third wider at base than thorax, sides subparallel to apical fourth, then feebly converging to the separately rounded tips; striæ fine, their punctures small, close-set; intervals flat, each

with a single row of minute, hair-bearing punctures. Under surface very finely and sparsely punctate. Length 5.5 mm.

Dunedin, March 29, 31; swept from huckleberry. Smaller and paler than our other species, the antennal joints relatively broader, the second and third shorter than in any of the others.

Toxotropis floridanus Leng.—This prettily marked little Anthribid occurs on ferns in dense hammocks, a half dozen or more having been taken near Dunedin, January–March. It was described from Enterprise, Fla., and is not known outside the State.

Rhinomacer pilosus Lec. — Although it is said that the species of *Rhinomacer* occur exclusively on coniferous trees, a dozen or more specimens of *R. pilosus* were swept from an Ericad, *Xolisma fruticosa* Michx., near Dunedin, in January. The plant was then full of the fruit or seed pods of the season before, and the weevil was doubtless living in or among these.

Tachygonus lecontei Gyll.—This species is not mentioned in any of the lists of Florida Coleoptera. It has been taken by the writer at Jacksonville, Ormond, Lakeland and Dunedin, a half dozen or more having been secured the past winter by beating oak about the borders of ponds or hammocks.

Listronotus floridensis Blatch.—This well-marked weevil was found in numbers near Moore Haven, March 2, on the flowers of an arrow-head (*Sagittaria*). Fresh specimens are more conspicuously and densely scaly than any of the allied species.

Otidocephalus dichrous Sz.—Occurs at light; three specimens taken in June at porch-light, having been sent me from Dunedin.

Anthonomus costulatus Suff.—This is a submaritime species frequenting the foliage of the Florida buttonwood, *Conocarpus erecta* L. It was taken in numbers on Hog Island in February and March.

Anthonomus sexguttatus Dietz.—Both this species and *Neomastix solidaginis* Dietz occur frequently about Dunedin on the flowers and foliage of a tall scurfy Ericad shrub, *Xolisma ferruginea* Walt., which grows in very dry sandy soil. The *Neomastix* was also taken at Lakeland and Ft. Myers.

Baris scintillans Casey.—This, the smallest and one of the most shining members of a large genus, was taken at Lakeland and Moore Haven in some numbers by sweeping low vegetation about the borders of lakes. It is probably wide spread throughout southern Florida.

Nicentrus grossulus Casey.*—This name should replace that of *Nicentrus canus* Lec., on page 392 of the "Rhynchophora of N. E. America," and *Limnobaris canus* Lec. should be inserted near the top of page 402 of that work. A specimen of *N. grossulus* was swept from the low sea-blite, *Batis maritima* L., on Hog Island, March 26. *L. canus* Lec. is known from Enterprise and St. Augustine.

Conotrachelus seniculus Lec.—This was found to be a common weevil at Ft. Myers, La Belle and Moore Haven, where numbers were taken by sweeping low vegetation, and also at light.

Conotrachelus belfragei Lec.—A single specimen of this handsome species was taken on Hog Island, March 14, by beating the seaside grape, (*Coc-*

*Ann. N. Y. Acad. Sci., VII, 1893, 599.

coloba uvifera L.). One had previously been taken at Eustis. These are the only two records for Florida, the species having been described from Texas.

Chalcodermus inæquicollis Horn.—This species was found hibernating in the axils of a tall thistle growing on Hog Island. A dozen or more specimens were there taken while searching for *Paragraphus setosus*. It is known also from Capron and Buck Key, Fla., and from Georgia and Arkansas.

Tyloderma maculata Blatch.—A single example of this prettily marked weevil was taken March 3 by beating at Moore Haven, and another on Hog Island, March 26, while sweeping *Batis*. It was described from a unique taken at Little River, Fla.

Tyloderma lævicollis, sp. nov.—Elongate-oval; smaller, more slender, with sides more parallel than any other of the brown forms. Dark reddish brown; the head, thorax and legs strongly shining. Head and beak rather finely, not densely punctate, without frontal fovea, the punctures isolated, not confluent or reticulated as in *variegata*; beak stout, about as long as head, carinate above. Thorax longer than wide, strongly produced over the head, sides feebly rounded; disk very minutely and sparsely punctate, each puncture bearing a minute prostrate white hair; flanks behind the ocular lobe strongly concave and coarsely punctate. Elytra one-third wider than thorax, sides parallel from humeri to apical third, then converging to the obtuse apex; striæ shallow and sparsely punctate on basal half, much deeper and without punctures toward apex; intervals feebly convex; disk with scattered small patches of white hairs, which tend to form very narrow, broken cross-bars. Last ventral coarsely punctate, abdomen otherwise almost smooth; sterna coarsely and sparsely punctate. Length 3 mm.

Two specimens taken March 4 by beating at the point where the Palm Beach Canal leaves the east shore of Lake Okeechobee. The elongate slender form, almost smooth thorax and deep, subapical striæ of elytra readily separate this from any known species.

Cryptorhynchus apiculatus Gyll.—This species is not so scarce as is commonly supposed. A half dozen or more have been taken at Dunedin in February and March, and one at Okeechobee City, March 6. It occurs on dead branches in wet hammocks.

Cryptorhynchus schwarzi Blatch.—A single example of this elongate, dull coloured form was taken near Moore Haven, March 1. The type was from the north end of Lake Okeechobee and the only other known specimens are from Biscayne Bay, so, as far as known, it is confined to southern Florida.

Caulophilus latinasus Say.—Hibernates in bunches of Spanish moss, numerous specimens having been taken at Lakeland, Feb. 21.

Pentarthrinus atrolucens Casey.—One specimen taken by beating dead branches in Skinner's Hammock, Dec. 20. Recorded before only from Enterprise and Biscayne Bay, Fla.

Calandra linearis Hbst.—A West India species known as the tamarind weevil. A single specimen was beaten from oak in open sandy woods near Lakeland, Feb. 22. Not before definitely recorded from Florida.

NEW ENGLAND HEMIPTERA-HETEROPTERA.

New Records.

BY H. M. PARSHLEY, SMITH COLLEGE, NORTHAMPTON, MASS.

Since the publication of my New England List* a number of additional species and significant records have come to light, together with a few errors which require correction. All available information on these points is brought together here in the belief that the value of such a list can be maintained only by keeping it up to date. New England records have particular interest for students of distribution in Canada, and some interesting comparisons should be brought out in connection with studies now in progress on the Hemipterous faunas of the eastern and western regions of the Dominion.

In the following notes bold-faced type is used to indicate forms new to the list; italics to mark those previously recorded. In all trinomials here and in the List the third name is varietal, not racial. For collectors' names see the List.

LYGÆIDÆ.

Geocoris bullatus var. *discopterus* Stal.

Mass.—Northampton, 5 June, '18, (*H.M.P.*).

Kolenetrus plenus (Distant).

N. H.—Crawfords, 28 Sept., '16, (*H. M. P.*).

Trapezonotus arenarius (Linné).

Me.—Casco Bay (*fide* Barber).

N. H.—Claremont (*G. P. E.*) (*fide* Barber).

Drymus unus (Say).

Mass.—Northampton, 14 Nov. '17, (Esther W. Hall).

TINGIDÆ.

Corythucha pallipes Parshley.

In Gibson, Trans. Am. Ent. Soc., 1918, vol. 44, p. 82.

Conn.—Stamford, 16 Aug, '12, (*W.E.B.*).

Corythucha cyrta Parshley.

In Gibson, Trans. Am. Ent. Soc., 1918, vol. 44, p. 86.

Me.—Ft. Kent, 17 Aug., '10, (*C.W.J.*); Liberty, 16 Sept., '13, (*J.A.C.*); Orono, 4, June, '07.

N.H.—Bretton Woods, 26 June, '13, (*C.W.J.*).

Mass.—Beach Bluff, 21 June '15, (*H.M.P.*); Chester, 27 May, '12, (*C.W.J.*).

Corythucha betulæ Drake.

In Gibson, Trans. Am. Ent. Soc., 1918, vol. 44, p. 86.

Me.—Cumberland, May, '16, (*A. Nicolay*) (*fide* Drake in litt.).

Corythucha borealis Parshley.

In Gibson, Trans. Am. Ent. Soc., 1918, vol. 44, p. 92.

Me.—Orono, 14 July, '11.

Leptostyla heidemanni Osborn and Drake.

Mass.—Sunderland, Mt. Toby, 15 Aug., '18, (*H.M.P.*).

*Occas. Papers of the Boston Society of Natural History VII, Fauna of New England. 14. List of the Hemiptera-Heteroptera, 1917.

MESOVELIIDÆ.

Mesovelia mulsanti White.

MASS.—Sunderland, Mt. Toby, 23 Sept., '17 (*H.M.P.*).

NABIDÆ.

Nabis sordidus Reuter.

MASS.—Northampton, 21 Oct., '18, (*H.M.P.*).

ANTHOCORIDÆ.

Xylocoris cursitans (Fallén).

MASS.—Sunderland, Mt. Toby, 11 Oct., '17, (*H.M.P.*).

MIRIDÆ.

Paracalocoris scrupeus var. *bidens* McAtee.

MASS.—Northampton, 22 June, '18, (*H.M.P.*).

Paracalocoris hawleyi var. **fissus** McAtee.

ME.—Princeton, 12 July, (*C.W.J.*).

Paracalocoris colon var. *amiculus* McAtee.

MASS.—Northampton, 8 July, '18, (*H.M.P.*).

Dichrooscytus elegans Uhler.

MASS.—Beach Bluff, 28 June, '15, (*H.M.P.*).

Horcias dislocatus (Say).

MASS.—Sunderland, Mt. Toby, 6 July, '18, (*H.M.P.*).

Horcias dislocatus var. *coccineus* (Emmons).

MASS.—Sunderland, Mt. Toby, 6 June, '18, (*H.M.P.*).

Platylygus luridus (Reuter).

Knight, Bull. Brooklyn Ent. Soc., 1918, vol. 13, p. 16.

N. H.—Claremont, 10 July, (*G. P.E.*).

Lygus vitticollis Reuter.

MASS.—Northampton, 4 June, '18, (*H.M.P.*).

Neoborus pubescens Knight.

Bull. Brooklyn Ent. Soc., 1917, vol. 12, p. 81.

N. H.—Hanover, 3 July (*C.W.J.*).

Dicyphus vestitus Uhler.

N. H.—Mt. Washington, 3,000 ft., 4 July, '13, (*C.W.J.*); Crawfords, 28, Sept. '16, (*H.M.P.*)

Macrolophus separatus (Uhler).

Mass.—Whately Glen, 5 Aug., '18, (*H.M.P.*).

Lopidea heidemanni Knight.

Ent. News, 1917, vol. 28, p. 456.

VT.—Bennington, 24 June, (*C.W.J.*).

MASS.—Natick, 20 June, '14, (*C.A.F.*).

CONN.—S. Meriden, 1 June, (*H.L.J.*).

Lopidea reuteri Knight.

Ent. News, 1917, vol. 28, p. 459.

MASS.—Chester, 8 Aug., '12, (*C.W.J.*); Fall River, 11 Aug.; Rutland, 31 Aug., '16, (*C.W.J.*); Sharon, 3 Aug., '09, (*C.W.J.*); Southbridge, 16 July; Williamsburg, 7 Aug., '11, (*C.W.J.*).

CONN.—Portland, 10 July, (*A. E. Moss*), 10 Aug., (*B.H.W.*).

Lopidea staphyleæ var. **sanguinea** Knight.
Ent. News, 1917, vol. 28, p. 461.
Mass.—Brookline, 4 July, Mt. Tom, 14 July, '07, (*C.W.J.*).
Conn.—Mt. Carmel, 24 July, (*W.E.B.*).

Diapnidia provancheri (Burque).
N. H.—Alstead (*A.P.M.*) (*fide* Van Duzee).

Diaphnidia capitata Van Duzee.
Mass.—Beverly, 23 July, '17, (*E.B.*).

Orthotylus uniformis Van Duzee.
Mass.—Beach Bluff, 28 July, '17, (*H.M.P.*).

Orthotylus catulus Van Duzee.
Conn.—Mt. Carmel, 25 May, '06, (*B.H.W.*).

Cyrtorrhinus caricis (Fallén).
Mass.—Cohasset, 8 Sept., (*C.W.J.*); Nantucket, 6 Aug., '13, (*J.A.C.*).

Mecomma gilvipes (Stal.).
Records given for *M. ambulans* (Fallén), List, p. 102, pertain to this species.

Macrotylus amœnus Reuter.
Mass.—Sunderland, Mt. Toby, 8 July, '18, (*H.M.P.*). Very numerous in upland pasture.

Oncotylus punctipes Reuter.
Me.—Calais, 10 July, (*C.W.J.*); Eastport, 15 July, '09, (*C.W.J.*).

Reuteroscopus ornatus (Reuter).
Mass.—Northampton, 3 Oct., '17, (*Esther W. Hall*).

Microphylellus modestus Reuter.
Vt.—Burlington, 22 June, '06, (*C.W.J.*).

Campylomma verbasci (Meyer-Dur).
Mass.—Northampton, 21 June, '18, (*H.M.V.*).

SALDIDÆ.

Pentacora hirta (Say).
Conn.—Branford, 11 Aug., '04, (*H.L.V.*).

CORRECTIONS.

Pages 8-9. In the Palæarctic list add *Scolopostethus thomsoni*, *Cyrtorrhinus caricis*, *Oncotylus punctipes*. Delete *Mecomma ambulans*.

Page 29, line 6. For (*G.P.E.*) read (*J.R.T.B.*).

Page 50, line 17. For **Rhyparochromus** read **Kolenetrus** and insert reference: Barber, Concerning Lygæidæ, No. 2, Jour. N.Y. Ent Soc., 1918, vol. 26, p. 49.

Page 51, line 14. **Delochilocoris** should probably read **Aphanus** (Barber, op. cit., p. 61).

Page 54, line 19. For **cratægi** Morrill read **cydoniæ** Fitch.

Page 82, line 2 from bottom. For **punctatus** (Zetterstedt) read var. **oblineatus** (Say).

Page 86, line 8. For Knight read Reuter. Delete the next line.

Page 107, line 11. Insert Forest Hills.

Page 119, last line. Insert additional data: 22 Aug., (*N. Banks*).

Mailed March 31st, 1919.

ACHORUTES SOCIALIS UZCH.

An example of the sub-order Arthropleona.
(See p. 73.)

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POPULAR AND PRACTICAL ENTOMOLOGY.

Remarks on Collembola.

BY CHARLES MACNAMARA, ARNPRIOR, ONTARIO.

That ingenuous character, the Man in the Street, commonly holds the erroneous opinion that an entomologist is a person who knows all about insects. Consequently, on the rare occasions when he brings some Entomological Department a "bug" to be named, if his specimen happens to be anything a little less common than a cicada or a Luna moth, he sustains a distinct shock when he finds that even the professional entomologist cannot tell him offhand exactly what it is, and must refer it to a specialist for determination. Our friend's surprise is, of course, due to the fact that he does not realize the vast, overwhelming abundance and variety of insect life; and he is not aware that no investigator, however studious, can even in the course of a whole life-time become acquainted with more than a small proportion of the prodigious number of different creatures included in the class Hexapoda.

And, besides the sole weight of numbers forcing the student of insects to specialize if he wishes to make any real progress, other influences also work in the same direction. The moths and butterflies, for instance, attract such a host of collectors as much by their beauty as by their biological interest, that there are probably more students of Lepidoptera than of all the other orders put together. Beetles, too, make a fine showing in a cabinet, and Coleopterists are legion. Then again, we are forced to give earnest if unwilling attention to those pestilent and all too numerous insects that devour our crops, bite our bodies, inoculate us with disease, or otherwise interfere with our living. All this tends to focus entomological study on certain handsome or obnoxious orders and categories, while other less showy or more inoffensive insects are passed over.

One of these neglected orders is the Collembola, familarly known as Springtails. These insects are so minute that, preserved in alcohol in tiny vials or mounted on microscope slides, they make no display in a collector's cabinet. And they are practically without economic importance. Some slight injuries to garden and greenhouse have been alleged against them, but their very worst depredations bear about the same relation to the virulent activities of say the locusts or the mosquitoes, as a small boy with a peashooter does to a German army corps invading Belgium. Consequently, they have been little studied.

Unassuming and harmless as they are, however, they have always attracted some attention. Owing to their wide distribution and, at times, extraordinary abundance, they drew some notice even from the earliest naturalists. I do not know that they are mentioned in the classic though unreliable pages of the Elder Pliny, but Linnæus did not overlook them, and with his passion for classification, duly tabulated them in his great "Systema Naturæ" under the generic name of Podura.

But a century later we find Nicolet reproaching naturalists that they have attached but little importance to the study of the order; and in 1872 Lubbock in his elaborate Monograph repeats the same complaint. Even to-day the sum of Collembola literature,—for the most part scattered through reviews and "proceedings" in half a dozen different languages—comprises only a few score papers. Nicolet's Memoir of 1841 and Lubbock's Monograph of 1872, although both beautifully illustrated with drawings and coloured pictures of an excellence seldom seen in modern insect books, are not nowadays of much use to the systematist. Linnaniemi's large Memoir (1907–1912) on the Apterygotan fauna of Finand is very useful to the American student, as many European species occur here. Guthrie's "Collembola of Minnesota" (1903) is the most comprehensive American volume, but the collector in this part of the country soon comes across numerous species not mentioned by Guthrie. However, Dr. J. W. Folsom, of the University of Illinois, the well-known authority on the Order, has lately published several exhaustive memoirs on certain of the North American sub-families, and I understand has others in preparation, so we may hope to have soon accurate and authoritative descriptions of all the known species on this continent. And we should be glad of this, for the Collembola are well worthy of study. The economic entomologist with his mercenary instincts may elect to ignore them, but their exceedingly primitive development makes them intensely interesting to the student of insect genealogy; while the astonishingly wide dispersal of some of their species and genera over the globe points to the immense antiquity of the Order, and sets some hard problems for the geologist to account for the primordial distribution of land and water.

If the bees and the ants be regarded as the aristocrats of the insect world, we must look on the springtails as belonging to the submerged tenth. They are among the most primitive of the "six-leggers." Some writers class the Thysanura as the lowest of the true insects, while others confer that doubtful honour on Berlese's Mirientomata; but all agree in placing the Collembola second on the list, only one step above the simplest known hexapods. The Order is divided into two suborders: the Arthropleona and the Symphypleona—which may be translated as the "Jointed-abdomens" and the "Together-grown-abdomens." The terms well express the difference in the appearance of the two divisions. The Arthropleona, which are considered the more primitive, have a well-marked head carried horizontally and bearing a pair of antennæ usually four jointed (but six jointed in one genus). The thorax consists of three conspicuous segments each with its pair of rather short legs, and the elongated abdomen is made up of six distinct divisions. In the Symphypleona the head is vertical, the constricted prothorax simulates a neck, while the other thoracic divisions are fused with the abdomen into an unsegmented globose body, the insect somewhat resembling a minute spider. (See plates III and IV.)

All the Collembola are without wings, and as no trace of these appendages can be found in the embryo at any stage of its growth, it is apparent that the wingless condition is primitive, and not the result of degeneration, as in the case of numerous other insects. Typically the mouth-parts of both sub-orders are withdrawn within the head, and are adapted for chewing, but in a few genera they project in a suctorial cone.

About 700 species of Collembola have been described so far, and of these some 200 have been found in North America. But there are certainly a large number to be discovered yet. Dr. Folsom estimates the collembolan fauna of this continent at not less than 250 species..

They are all very small, delicate insects, ranging from one-half millimeter to five millimeters in length, but the commonest kinds are from one to two millimeters long. Their integument is very soft, and great care is necessary in handling them. Most of them are clothed, thinly or densely, with hairs of a remarkable variety of form. There are long, slender, simple hairs, and stiff, spiny bristles; there are wide, ribbon-like hairs, and hairs terminating in fancy spear heads and in cups; there are hairs with flat, broad bases notched along one edge; there are feathered hairs, clubbed hairs and hairs bent over sharply at the ends. Of course, no one species possesses all these different kinds of hairs, but most springtails can boast of three or four varieties at least. For convenience sake, we speak of these growths as hairs, but they have little in common with the hairs of a mammal that grow out through the skin like an onion in a garden bed. A springtail's hairs are really continuous outgrowths of the integument, and when the insect moults its skin, as it does frequently in the course of its life, it sheds the outer layer of these so-called hairs also.

A few genera are covered with scales, not unlike the scales on a butterfly's wing, but very much smaller. These scales are lined and fluted so minutely that they are often used as test objects for microscopes, and the exact nature of the markings appears to be as hard to make out as the pattern on a diatom.

In colour the Collembola run through the whole spectrum from red to violet with black and white thrown in. Some are coloured uniformly all over, some are irregularly blotched and spotted and some wear veritable Joseph's coats of complicated symmetrical designs. Most of the colour is pigmentary, but the scaled species often show beautiful iridescence.

Some species are very constant in their coloration, while others assume several different liveries according, it would seem, to their food or their habitat. Thus *Sminthurus hortensis* Fitch, taken on garden beds, is a very dark purple with minute yellow spots, whereas a bright yellow variety, indistinguishable in everything but colour, is found living in the adjacent grass. *Achorutes armatus* Nic. may be a dirty white, pale violet, wine colour, or dark blue; and one variety, Dr. Folsom says, is canary yellow mottled with lavender. The common and abundant *Podura aquatica*, known all over the northern hemisphere, has always been described from the time of Linneus himself as dark blue with red brown legs and antennæ. But *P. aquatica*, recently found in the vicinity of Arnprior, Ontario, is coloured uniformly red all over. Indeed, variations of this kind are so common among the Collembola that colour is scarcely of any diagnostic value at all.

The most striking feature of the Collembola is the leaping apparatus to which they owe their popular name of Springtails. This apparatus is not characteristic of all the Order, however, for there are a good many species without any springing device at all, and in others it is so poorly developed as to be inoperative; but the majority are active jumpers. The apparatus, which is known as the furcula, consists of a forked appendage, (the dentes) hinged by a broad base, (the manubrium), to the belly at the fourth abdominal segment,

and is normally folded under the insect with the free forked end towards the head. The dentes terminate in curious hooked and toothed pieces (the mucrones) plainly designed to give the insect a firm purchase for its leap; and with the same object in view, the underside of the dentes are often studded with spike-like setæ. The acme of stinginess is reputed to have been reached by a man who used a wart on the back of his neck for a collar botton. Without accusing the springtail of parsimony, it must be stated that it adopts much the same means to hold its furcula in place. On the third abdominal segment is a curious little double-fingered protuberance (the tenaculum) which, when the furcula is folded in place, projects between the dentes. The fingers of this excrescence each provided with three or four teeth to ensure a firm grasp—bending outwards against the dentes, serve to hold the furcula close along the belly, where it is under considerable tension from the muscles of the manubrium. When the fingers of the tenaculum are relaxed, these muscles pull the furcula strongly downwards and backwards, and the insect is flung upwards into the air. Anyone who remembers that homely toy, the goose-bone jumping jack, that used to delight the children of a past generation, will readily understand how a springtail leaps.

The length of a jump may be as much as five or six inches. An *Achorutes socialis*, one millimeter long, easily springs four inches or 100 millimeters, and *A. socialis* is by no means one of the most active species. In proportion to the size of the insect, these are prodigious leaps. It is as if a man could cover a mile in nine or ten bounds.

While in the air, the insect folds the furcula back into place again, so that on alighting it is immediately ready for another leap, and it almost invariably comes down on its feet. Only a few species, however, such as *Tomocerus flavescens*, jump several times in quick succession. Generally there is an interval of half a minute or more between the leaps. And, as a rule, leaping is only resorted to in order to escape from danger. The usual mode of progression is walking or running by means of the legs; although the migrating kinds when on the march, keep leaping from time to time, but apparently largely at random.

While the springing apparatus is the most noticeable structure of the majority of the Collembola, it is not the distinguishing mark of the Order, for, as already mentioned, a good many species are entirely without it. It is the possession of the mysterious organ known as the "ventral tube" that decides the springtail lineage. This organ, situated ventrally on the first abdominally segment, is in some species merely a cleft tubercle, the sides of which open back like the jaws of a steel trap, exposing a wet, stickly-looking disc within. In other species it takes the form of a relatively long, projecting tube, from which (among some of the Symphypleona) can be protruded two lengthy, slender, transparent filaments, thickly studded with circular glands.

Dissection does little to explain the use of the organ, but Sir John Lubbock named the order Collembola—literally "glue-insertion"—from the idea, common to most entomologists of his day and apparently still held by some writers, that the ventral tube enabled "the creature to attach or glue itself to the body on which it stands." That this is the special function of the organ seems very doubtful. Springtails do not appear to be in any particular need of attaching themselves so securely to surfaces. They do not habitually live upside down,

nor are they especially exposed to shocks that might shake them loose from their hold. And Guthrie is mistaken in saying that their feet are not well adapted for smooth surfaces. It is true that the feet are lacking in any kind of a pad or sucker; and it is not likely that the two or three clubbed or geniculate setæ—the so-called tenent hairs—that in some species project over the usual pair of curved pointed claws, are anything more than tactile in function. But however they manage it, the thirty or forty species that I have observed in life, whether with two claws on each foot or only one, and with or without tenent hairs, could all run nimbly on dry, polished glass, even back downwards; and such a surface is infinitely harder and smoother than any they ever encounter in their natural habitat.

In support of his opinion that the ventral tube is an organ of attachment, Lubbock says that if a Sminthurus is laid on its back and a piece of glass is brought within its reach, "the animal will endeavour to seize it with the feet, but at the same time it will project one or both of the ventral tentacles and apply it, or them, firmly to the glass, emitting at the same time a drop of fluid which, no doubt, gives a better hold." This surmise may sound plausible in the particular instance, but an extended observation of the actions of different species as regards the ventral tube leads to another view of the probable function of the organ.

The Collembola are all extremely sensitive to any lack of humidity in their surroundings. Most species, if put into a dry vial, will die and begin to shrivel up within an hour. The only way to keep them alive in captivity for any length of time is to put in the vial some source of moisture such as wet, rotten wood or damp filter paper. Evaporation through the thin epidermis is so rapid, that it appears not unlikely to me that the ventral tube has to do with supplying or regulating the large quantity of moisture the insect requires.

This conjecture seems to be borne out by the conduct of more than one species For instance, a yellow Papirius—(a genus closely related to the Smynthurus mentioned by Lubbock) found in the autumn under dead leaves of hardwood forests, stands high on its legs, neither its ventral tube nor any other part of its abdomen normally touching the surface it rests on. In a vial, it has no trouble in walking on the glass in any position; and it remains for hours and even days clinging to the glass, back downwards, by its feet alone, maintaining its hold without any help whatever from the ventral tube.

Of a dozen or so of this species kept in a vial with the usual morsel of moist, rotten wood or damp filter paper, the majority remain thus motionless for long periods. Then suddenly, with startling swiftness, one of them shoots out its ventral filaments on either side of its body, and applies them closely to the glass along their whole length, always—so far as I have observed—where there is a film of moisture on the glass. The filaments, which are tubular and provided with a number of sucker-like glands at the ends, are longer than the insect's entire body, but are evidently stowed away by the smaller apical half telescoping into the larger basal section. After leaving the filaments in contact with the glass for a minute or two, the insect draws them in as swiftly as it shot them out, changes its position slightly, and darts them out again. This performance may be kept up for ten minutes or so, and then finally drawing in the filaments permanently, the insect lapses into quietude again.

This Papirius makes use of its ventral filaments also when washing itself, which it does frequently, very much like a cat. From its mouth it exudes a small, bright drop of liquid, and taking it on the claw of one of the forelegs—where it looks like a gleaming boxing glove—it rubs it briskly over its antennæ, head and legs. Sometimes it transfers the drop to the claw of one of the second pair of legs so as to reach farther down the body. The drop often remains unbroken during these proceedings, and with laudable economy, is then returned to the mouth and swallowed again. The washing operation almost invariably ends by the swift extrusion of a short piece of one of the ventral filaments, which is also apparently rubbed over with the remains of the drop; or moisture is transferred between it and the mouth. But the action is so rapid that I have never been able to make out exactly what occurs.

Guthrie observes of *Orchesella zebra*, which one morning after a shower he found in great numbers on the moist surface of stumps in the woods, that "they moved about fitfully at time, but often stopped and squatted down to bring the ventral tube into contact with the moisture." And some additional light is thrown on the use of the organ by watching the conduct of *Achorutes socialis* Uzel in a vial. The ventral tube in this species is simply a low cleft protuberance, which on opening, exposes a wet, sucker-like disc. When the vial containing a number of newly caught *A. socialis* is laid on its side, the insects first run around busily in every direction, maintaining their hold on the glass in every position without any assistance from the ventral tube. But every now and then, one of them opens the tube, and applies the disc to the glass. It still keeps its legs going, but now can only drag itself along slowly, as the attachment to the glass greatly impedes its way. In a few moments it withdraws the disc—sometimes leaving a trace of moisture on the glass,—closes the tube, and runs off briskly as before, only to repeat the action a little later on. After awhile, the insects quiet down, and come to rest closely packed side by side all around the circumference of the bottle. Many of those that are hanging back downwards are seen to have the ventral tube applied to the glass; but this cannot be merely for support, for the insects resting on the lower side of the bottle, where no attachment is necessary to maintain their position, are found, with few exceptions, to have their tubes in contact with the glass also. And a few hours later the still, motionless insects all around the bottle are discovered to be holding by their feet alone, with their ventral tubes without exception all closed.

To me, the evidence points strongly to the conclusion that the ventral tube is not primarily intended to maintain the insect's hold, and the probability is great that it acts as a kind of regulating valve, controlling and supplementing the supply of moisture.

Nor does the suggestion that the ventral tube is a breathing organ seem any better founded than the "attachment theory." The fact that the Collembola—with the exception of one or two genera of the Symphypleona—are without air tracheæ might seem to lend weight to the hypothesis. But Sminthurus and one or two others which alone have a tracheal system, also have the most highly developed type of ventral tube with long, extensible filaments, and it is against all the economy of nature that two distinct sets of apparatus should be provided for the same purpose.

In addition to the conspicuous organs we have been discussing, the Collembola display several minor structures that no doubt are sense organs of some kind, but what their precise functions are, and indeed what senses the insects really possess, we can only guess. Many species seem to get along quite well without sight, and the eyes of those endowed with vision are very simple constructions compared with the enormous compound eyes of some of the flying insects. The sense of touch—the most primitive of all the senses, and common to every manifestation of life—is doubtless served by the numerous strange "hairs" that cover the insects' bodies as well as by the antennæ. The very necessary sense of taste it is reasonable to suppose is situated in the mouth. And possibly the closely-allied sense of smell has its seat in the curious depressions each with a "peg" in the centre that sometimes indent the sides of the antennæ, or in the remarkable buds and tubercles often seen on the same organs. But it is hard to divine the use of the strange bladder-like sac that *Achorutes armatus* Nic. can evert from between its last two antennal segments. Equally mysterious are the "post-antennal organs," those rosettes of scales situated on the head between the base of the antennæ and the eyes in many species. They may be auditory, but, of course, we have no evidence that the insects can hear at all. Another peculiar feature of certain species are the two or three sharp, curved spines that grow out of the last abdominal segment. But whatever use these "anal horns" are to the animal, at least they justify their existence to the puzzled entomologist by helping him in the often difficult task of determining the species.

As the systematic observation of such minute insects in their habitat is practically impossible, and as it is very difficult to keep them in captivity under natural conditions, the details of their life-history are not well known.

The Collembola pass through no larval stage, and undergo no metamorphosis whatever. The white or yellow spherical eggs, about one-eighth of a millimeter in diameter, are generally quite smooth, although Nicolet figures some hairy ones. They are laid singly or in masses like bunches of grapes under bark, among dead leaves and in many other damp situations. The masses often contain from 50 to 100 eggs, and bulk much larger than the body of the insect, but are usually all stuck together with every appearance of being the product of one female. Oviposition apparently takes place only in the dark. Several species lay eggs freely in captivity, but I have never been able to observe the operation; and an English writer says that in 50 years' study of the insects he has never succeeded in seeing how the eggs are laid. Until some one discovers how to circumvent this coyness of the mother springtail, we shall not know whether, despite appearances, more than one female contributes to the egg cluster, or whether we must accept the decidedly improbable suggestion that the eggs increase in size after laying.

Incubation at room temperature takes from 10 to 35 days, according to the species. The large variation in the size of individuals of the same species taken at the same time points to more than one brood in the season, but they are so difficult to rear that exact data on this point are lacking. In captivity, *Achorutes socialis* Uzel and some other species lay only in the spring, while

Achorutes humi Folsom and *Neanura muscorum* Templeton oviposit late in the fall. The eggs of the last-named took 35 days to hatch at an average temperature of 60 F. This is a remarkably long period compared with the 10 or 12 days required by the eggs of *Achorutes socialis* under the same conditions; and in the insects' natural habitat incubation would doubtless have been even longer, for the young Neanura appeared in my bottles on the 8th January; and in their native wilds, sheltered from the intense frost only by the bark of a rotten log, it is scarcely likely that they would have hatched before spring.

On emergence from the egg, the young of a two millimeter adult are about one quarter of a millimeter long, and are invariably white, with—except in the blind species—conspicuous black eye spots. They are perfectly developed, but are not of quite the same proportions as the adults,—being somewhat shorter and thicker—and are wonderfully active runners and jumpers. Their growth seems to be slow, but it is scarcely safe to generalize on this point from the progress of the young in captivity, for they do not thrive under artificial conditions. *Achorutes socialis* and *Achorutes packardi* captured when well grown, have lived for six to eight months in my vials, and it was more than a year before senile decay carried off *Xenylla maritima*. But though I have seen the young of half a dozen species hatch out, not one of them ever survived longer than two or three weeks; and during this brief life I could never notice any marked change in their appearance.

Some species at least are sexually mature a good while before they attain their maximum size. *Achorutes socialis* reaches a body length of two millimeters, but specimens only one and a quarter millimeters long lay eggs. The number of moults, so constant with many insects, is I suspect with them indefinite, for they seem to keep on shedding their skins and growing as long as they live. The largest sized specimens of several species that I am familiar with are found only in the spring. Apparently belonging to some brood of the year before, in spite of the almost sub-arctic cold of this district, they have continued to grow all winter in their shelters under the snow.

Their food seems to consist of organic matter of almost any kind. They have been found feeding on dead molluscs, fish and birds along the shore, but probably vegetable substances supply most of their nutriment. The mandibulate mouth-parts possessed by the majority are obviously designed for chewing. Some of the species I have had under observation fed on rotten wood, moss and lichens; others—notably the Arthropleona—would not eat at all in captivity.

No matter how small you are, trouble won't overlook you, and even the minute springtail has its enemies. Lubbock and some others refer to the presence of Protozoa in the internal organs of Collembola, and Imms found Nematodes in *Anurida maritima*. Nor are external parasites wanting. Of twelve or fifteen specimens of a small Sminthurus I collected last summer in the long grass of a beaver meadow, five had still smaller red mites firmly attached to them. This genus seems to be subject to attack by mites, for Lubbock mentions the same occurrence in connection with *S. fusce* (L.). Other likely enemies of the Order are the tiny spiders and chelifers, the thread-legged bugs and other predaceous creatures that one often finds in the collembolan habitats.

SMINTHURUS HORTENSIS FITCH.

An example of the sub-order Symphypleona.
(See p. 73.)

NEW PSAMMOCHARIDÆ AND PHILANTHIDÆ.

BY NATHAN BANKS, CAMBRIDGE, MASS.

The following new species are mostly from the northern and northwestern parts of the United States or from Canada.

Psammocharidæ.

Psammochares lasiope, n. sp.

♀ Black, basal part of abdomen reddish above and below, extreme base of first segment black. Head, pro- and metanotum densely clothed with rather long hairs. Clypeus truncate, margined; antennæ slender, second plus third joints fully equal vertex width, vertex from in front hardly convex; the lateral ocelli nearer to each other than to the eyes; hind border of pronotum angulate; base, tip, and venter of abdomen with few fine hairs, no bristles near tip of abdomen; legs slender, with short spines, three in comb on basitarsus, not very long; inner spur of hind tibia about one-half of the basitarsus. Wings nearly uniformly blackish, but not very dark; second and third submarginals subequal in size, both broad above, separated by a vertical vein, and receiving the recurrent veins near the middle; basal vein before transverse; in hind wings the fork is interstitial with the end of the cell.

Length 11 mm.

From Saranac Lake, 26 Aug.; Wilmington, 20–26 Aug.; New Russia, Essex Co., 18 Aug., all in New York, (Bradley). Differs from *atlanticus*, *autumnalis*, *marginalis*, in having longer hair on metanotum and broad-topped third submarginal cell; the spines of the comb are about the length of those in *marginalis*, much shorter than in *autumnalis* and *atlanticus*.

Anoplius depressipes, n. sp.

♀. Deep black throughout; wings uniformly black. The face is rather broader below than above, the clypeus very broad, nearly truncate below, but rounded at outer sides, vertex straight across, hind ocelli about as close to eyes as to each other, antennæ slender, second plus third joint equal vertex width; pronotum behind angulate, metanotum sloping, not very long, with a deep median groove, with long hair. Abdomen slender, basal and apical segments hairy above, all below; legs slender, not very spiny, those on the tibiæ hardly one-half of the width of joint, inner spur of hind tibia about one-half of basitarsus, anterior tarsi flattened, the outer edge angulate, concave below, no spines above on basitarsus, 2 in the concavity on lower outer side. Wings moderately long, second submarginal cell longer than wide, receiving the first recurrent beyond middle, third submarginal fully as long as the second, narrowed above, receiving the second recurrent vein near middle, latter curved, basal vein a little before the transverse; in hind wing the fork interstitial with the end of the cell. The head and thorax are clothed with rather long hair.

Length 12 to 16 mm.

From Ithaca, N.Y., 12 July (Needham); Spring Creek, Decatur Co., Ga., 16 July, (Bradley) and Burton, Ga., 21 May, (Bradley).

The nature of the anterior tarsus, especially the basal joint, will distinguish it from our other species of this genus.

Anoplius similaris, n. sp.

♀. Black throughout; wings uniformly black. Closely to *A. illinoiensis*. The clypeus is broadly, evenly concave below, in *illinoiensis* it is truncate and consequently longer. The face is a little broader at vertex than in *illinoiensis;* antennæ and ocelli about the same as in that species; the metanotum is a little shorter, more deeply grooved, the posterior slope more flattened across, the hairs shorter and much fewer than in *A. illinoiensis*. The abdomen similar but the last segment has only a few fine hairs, not the stiff bristles of *A. illinoïensis*. Legs slender, hardly as spiny as in *illinoiensis*, the inner spur of hind tibia a little more than one-half of basitarsus; the front basitarsus has no noticeable spines above, but two or three on the outer under side. Venation similar to *A. illinoiensis*, but submarginal cells a little larger, and the second recurrent vein not curved.

Length 15 to 16 mm.

From Ithaca, N.Y., 14, 25 July, (Bradley).

Lophopompilus autilone, n. sp.

♂. Related by the male genitalia to *L. æthiops*, differs in that there is a median, hairy ridge the whole length of the genital plate (in *æthiops* only at base). The under side of the first joint of the antennæ is hardly hairy; the hairs on the metanotum are not nearly as long or as dense as in *æthiops*, and the whole body is less hairy. The clypeal margin is slightly concave; the third submarginal cell is triangular, receiving the second recurrent vein near the middle, the latter bent near the middle; hind margin of pronotum almost angular; apical ventral segments with scattered hairs only.

Length 14 mm.

From La Belle, 8–10 May, Ft. Meyers, 7 May, Florida, and Billy Island, Okefenokee Swamp, Ga., all taken by Prof. Bradley.

Pompiloides canadensis, n. sp.

♀. Similar to *P. cylindricus* and *P. insolens;* differs from both by the shape of the basal plate of male genitalia being triangularly emarginate, the sides of the emargination divergent (instead of parallel); the last ventral segment is not so deeply emarginate behind as in *P. cylindricus*. Black throughout, not as much silvery as in *P. cylindricus*, the silvery appearance noticeable on face, thorax and coxæ. Head with rather longer hair than *P. cylindricus*, venter with few, but distinct hairs. Third submarginal cell usually short petiolate, the second sub-quadrate. About the size of *P. insolens*.

From Truro, Nova Scotia, 12 Aug., (Matheson); and Val Morin, 29–30 July, Canada (Ouellet).

Sophropompilus quadrispinosus, n. sp.

♀. Deep blue; wings blackish, nearly uniform, legs and antennæ black; clothed with short hairs. Clypeus truncate, third antennal joint hardly equal first, faint line to anterior ocellus, hind ocelli nearer to each other than to the eyes, vertex from in front slightly convex, pronotum arcuate behind; metanotum short, hairy, faint groove on the base; abdomen with short hairs above, longer at tip and below; femora plainly hairy above, inner spur of hind tibiæ two-thirds of the basitarsus, front tarsus has four long spines in comb on the first joint, these are almost flattened; wings and venation as in *S. hyacinthinus*.

Length 10 to 12 mm.

From Long Beach, L. I., N.Y., Aug., (Shannon); Chesapeake Beach, Md., 18 to 21 Sept.; Gulfport, Fla., April, (Reynolds); Billy's Island, Okefenokee Swamp, Ga., 1 to 5 Sept., (Bradley), and Tybee Island, Ga., (Bradley); evidently a coastal species. Body and legs more hairy than *hyacinthinus*, and with longer comb, four on first joint.

Ageniella eximia, n. sp.

♂. Black, apical parts of legs more brown; wings slightly fumose, not darker on tips. Small and very slender; face rather broad, hardly narrowed below, lateral ocelli plainly nearer to each other than to the eyes; pronotum behind strongly arcuate, metathorax sericeous on its sides. Abdomen very slender, basal segment about one and a half times longer than broad at tip; inner spur of the hind tibia little more than one-half of the basitarsus. Wings slender, rather short, marginal cell not its length from wing-tip, third submarginal higher than long, slightly narrowed above, receiving the second recurrent a little before middle, basal vein a little before the transverse.

Length 3½ to 4½ mm.

From Falls Church, Va., Ithaca, N.Y., 15 July to 10 Aug., (Bradley), Albany, and McLean, N.Y., 3 July.

Related to *A. iridipennis* Cress., but very much smaller, darker spurs and front legs, and slightly different in venation. Several specimens have the apical part of hind femora reddish, but otherwise agree.

Agriogenia, n. gen.

Based on *Agenia brevis* Cress. It agrees in general with *Ageniella*, but differs in being clothed with a fine, appressed, greyish yellow pubescence; the legs, especially the femora, are shorter and stouter than in *Agenia*, and the shape of marginal cell and third submarginal was noted by Cresson. The female, however, has on the underside of the head back of the mouth a curved row of long white bristles which look as though arranged to hold food. Nothing similar occurs in *Ageniella;* the head is flatter in the frontal region than in *Ageniella*.

PHILANTHIDÆ.

Cerceris completa, n. sp.

Male from Claremont, California, (Baker). Black, with yellow marks; face below antennæ, base of mandibles, stripe on scape beneath, spots on pronotum, the postscutellum, and legs (except basal two-thirds of femora, yellowish. Basal segment of abdomen black, second yellow above, with a median transverse black spot, pointed at each side, the following segments yellow with large basal, transverse, black spot, that on the third and fourth segments narrowed at extreme base; the venter with pale bands on second, third and fourth segments broader on sides, fifth with spots on side. Clypeus truncate in middle below; hair lobes small; enclosure smooth and shining; first abdominal segment plainly longer than broad, and not one-half the width of the second; other segments broad; pygidial area once and two-thirds longer than broad at base, rather broader at base than elsewhere. Body rather finely and densely punctate; head, thorax, and first segment plainly hairy; stigma yellowish.

Length 11 mm.

Cerceris snowi, n. sp.

Males from Tucson, Arizona (Snow) and San Diego Co., Cal., (Van Duzee). Black; lateral face marks, scape beneath, two spots on pronotum, the postscutellum, tegulæ, apical bands on the second and following segments, cream yellow, those on face nearly white; band on second segment much broader than others which are narrow and may be broken each side; tibiæ and extreme tips of femora pale, a dark spot behind on mid and hind tibiæ, the basitarsi pale. Flagellum of antennæ rather rufous beneath, especially toward tip. Face below densely white-haired; clypeal margin at middle faintly tridentate; enclosure smooth; the pygidial area elongate, about as in *C. kennicotti.* Head, thorax, first and second segments very plainly hairy. One specimen has two small spots on first segment, two have faint lateral spots on the scutellum.

Length 8 mm.

By small size and coarse punctuation related to *C. erigoni* and *C. acanthophila,* but distinct by having clypeus all black.

Cerceris interjecta, n. sp.

Male from Lake Point, Utah, 18 July, (Titus).

Black marked with yellow; first abdominal segment red above and below. Face with middle clypeal spot not reaching lower margin, and lateral spots yellow, sides of clypeus and the mandibles black; basal part of flagellum slightly rufous beneath; two spots on pronotum, the postscutellum, and broad abdominal bands, yellow, that on the second segment occupying one-half of the segment, not emarginate; third, fourth and fifth broadly emarginate in front, but on sides reaching the front margin of the segment, sixth with a small basal, median dark spot; venter all black; legs black, the tibiæ yellow in front, tarsi dark brown; stigma yellowish; pygidium mostly rufous. Face very broad; clypeal margin slightly rounded, hair-lobes very small; last joint of antenna as long as preceding, slightly curved; enclosure large, smooth, polished; pygidial area once and one-half longer than broad, sides nearly parallel. Body moderately, coarsely punctate; abdomen broad, basal segment.

Length 10 mm.

Cerceris abbreviata, n. sp.

Males from Yakima River, Little Spokane, and Umatilla, Washington, June and July, (S. Henshaw).

Black, marked with yellow, face, base of mandibles, scape beneath, dot behind eyes, pronotum, tegulæ, postscutellum, two spots on basal segment, narrow bands, all about of the same width on following segments, yellow; three pairs of ventral spots, usually connected; legs yellow, front and mid femora with black spot near base, hind femora and tibiæ black near tips; stigma yellowish; flagellum rufous beneath, last joint of antenna rufous, slender, curved. Face is narrower than *C. occipitomaculata,* the lateral lobes of clypeus being proportionately higher. Clypeal margin truncate; enclosure plainly longitudinally striate, but on sides more oblique; basal segment of abdomen very broad; pygidial area elongate, the sides parallel; head and thorax short-haired.

Length 8 mm.

In appearance a *C. nigrescens* marked with bright yellow instead of white, but a slightly smaller, and shorter bodied species.

Philanthus yakima, n. sp.

Washington—Yakima, 2 to 4 July, 1882, (S. Henshaw).

♀. Close to *P. flavifrons*, but smaller. Face, mandibles, scape beneath, streak behind eyes, two dots on vertex, collar, tegulæ, tubercles, spot behind, larger spot below, spot at posterior corners of mesonotum, adjoining spot each side on base of scutellum, postscutellum, spot each side on metanotum, broadly interrupted bands on first and second segments, bands on others, broad on sides, very narrow in middle, that on third deeply indented each side behind, broad bands on second, third and fourth ventral segments, all yellow. Legs (including coxæ) yellow, basal part of femora, rather more than one-half on hind femora, and spot toward tip of hind tibia black. Underside of flagellum rufous; stigma yellow. Punctured as in *flavifrons*, striately on front, few on mesonotum, rather deeply and evenly scattered on abdomen, but hardly as large as in *flavifrons*. Differs from *flavifrons* in that the enclosure has the posterior as well as lateral margins raised and smooth, making a horse-shoe-shaped area. The last dorsal segment is broadly triangular, and the sides not concave toward tip as in *flavifrons*.

Length 10 mm.

FURTHER NOTES ON THE LATIMANUS GROUP OF THE BEE GENUS MEGACHILE.

BY F. W. L. SLADEN, APIARIST, DOMINION EXPERIMENTAL FARMS.

In the Agricultural Gazette of Canada, February, 1918, page 125, I proposed the name *diligens* for *Megachile latimanus*, Ckll. not of Say. Professor Cockerell has informed me that the name *diligens* was given by F. Smith in 1879 to a *Megachile* in the Hawaiian fauna, so that it becomes necessary to find a new name for *latimanus* Ckll., and I propose *dentitarsus*. The difference between this and the other Canadian species of the *latimanus* group were pointed out in my table given in the Canadian Entomologist, September, 1918, page 302. There is, however, another character to which Professor Cockerell has called my attention. When the abdomen is viewed from above and slightly tilted, black hairs are prominent laterally in *dentitarsus* (*latimanus* Ckll.), but no black hairs project at side in *perihirta*, Ckll. (*grindeliarum* Ckll.).

OCCURRENCE OF THE PEAR THRIPS IN ONTARIO.

BY WM. A. ROSS, DOMINION ENTOMOLOGICAL LABORATORY, VINELAND STA., ONT.

The notorious pear thrips *Tæniothrips inconsequens* Uzel, hitherto unrecorded in Ontario, was taken by the writer last spring (1918) on pear trees in a large orchard near Beamsville. Fortunately the thrips was present in very small numbers and apparently was not causing any appreciable injury.

Thanks are due to Mr. P. J. Parrott, of the Geneva Agricultural Experiment Station, and Capt. J. D. Hood, Washington, D.C., for confirming the identification of this insect.

For the information of the reader it should be stated here that an excellent, detailed account of the known distribution, life history, habits and control of the pear thrips is given by A. E. Cameron and R. C. Treherne, of the Dominion Entomological Branch, in Bulletin No. 15—"The Pear Thrips and Its Control in British Columbia."

NOTES ON THE LIFE-HISTORY AND EARLY STAGES OF BRACHYS OVATUS WEB., AND BRACHYS AEROSUS MELSH.

BY HARRY B. WEISS AND ALAN S. NICOLAY, NEW BRUNSWICK, N.J.

Packard in his "Forest Insects" records *B. aerosus* as occurring on oak early in summer in Maine and late in May near Providence, R.I., and states that Gillette (Canad. Ent. July, 1887) reared it from larvæ in poplar leaves, the mines being finished in October and the beetles appearing early the following May. Concerning *B. ovatus*, this species is recorded by Packard as follows "on laurel oak; imago issues latter part of April and early May (Riley's unpublished notes)." Gillette also reports rearing the beetle from a larva mining a leaf of either red or black oak. Felt (N. Y. State Mus. Mem. 8; 2, p. 512–3) states that *B. aerosus* was taken while feeding on elm during the latter half of May, and that *B. ovatus* was common on scrub oak the latter part of May and June. Blatchley in his "Coleoptera of Indiana" records *aerosus* as throughout the state, frequent, May 16–June 18, occurring on oak, hickory, elm and *ovatus* also as throughout the state and frequent, May 16–July 13, on oak in the leaves of which the larvæ dwell. According to Smith (Rept. N. J. State Mus. 1909) *aerosus* is found throughout New Jersey, not rare, on oak, May, June and *ovatus* is common throughout the state, June to August on oak. Burke (U. S. Dept. Agric. Bull. No. 437, 1917) summarizes the distribution, common habits and host trees of the genus *Brachys* as follows:—"Eastern and Central States, leaf miner in leaves: *Populus* ?, alder (*Alnus*), *Fagus* ?, chestnut (*Castanea*), oak (*Quercus*), *Ulmus* ?, and *Acer*?"

In New Jersey, we have found the distribution of both species to be as reported by Smith, and have observed the adults feeding on foliage as follows: *B. ovatus* on elm (*Ulmus americana*), sugar maple (*Acer saccharum*), white oak (*Quercus alba*),chestnut oak (*Q. prinus*),pin oak (*Q. palustris*), chestnut (*Castanea dentata*), scrub oak (*Q. ilicifolia*), black oak (*Q. velutina*), post oak (Q. *minor*), beech (*Fagus ferruginea*), and hickory (*Hicoria glabra*) with the various species of oaks as preferred food plants; *B. aerosus* feeding on beech (*F. ferruginea*), linden (*Tilia americana*), witch hazel (*Hamamelis virginiana*), elm (*Ulmus americana*), chestnut (*C. dentata*), sugar maple (*A. saccharum*), red maple (*A. rubrum*),and various species of oaks with the oaks as preferred food plants, although quite a few adults were taken while feeding on red maple and beech.

The feeding of both species is quite characteristic. The beetles feed on the upper leaf surfaces usually near the edges consuming the tissue between the larger veins and working, as a rule, along a large vein. This habit results in feeding areas which are bounded on one or more sides by straight edges or lines giving the injury a sort of ragged geometrical appearance. After much feeding has been done at one spot, the small amount of remaining uninjured tissue weathers away in the course of time, resulting in irregular holes.

The mines of both species are somewhat irregular and blotch-like and may be found on any part of a leaf, the majority, however, occurring near the edge. As a rule each mine contains only one larva, and is found on a leaf which is comparatively uninjured by adult feeding. *Aerosus* mines take up only a small portion of a leaf, while an *ovatus* larva will frequently mine one-half or more of a medium-sized leaf. The mines of both species are visible on both leaf surfaces, more so on the upper where they appear as brown dead spots or areas. Some

VARIOUS LEAVES SHOWING BRACHYS. SP. FEEDING.

leaves when held up to the light are so mined that the characteristic larva is readily identified as a *Brachys* sp., while others have the mined area so brown that the light will not penetrate. However, a *Brachys* sp. mine can usually be identified as such by the dried, oval, flat, glistening egg shell which remains sticking to some portion of the upper surface of the mine long after the larva has left it. Mined leaves were found on small as well as large trees. On the large trees, however, only the outer leaves exposed to plenty of sunlight were infested.

Not all of the trees selected as food plants by theadu lts seem to harbour the larvæ in their foliage, and we have observed mines of both species only, as a rule, in the leaves of various oaks. In a few cases we have noted mines on chestnut and have taken larvæ therefrom. At Uhlerstown, Pa., eggs and adults of *B. aerosus* were plentiful on red maple leaves, but an opportunity for visiting this place later in the season was not afforded us, and it is not known if the leaves were mined.

In general, the life-history of both species is as follows. Adults appear about the middle or latter part of May and disappear by the first part of August, being most plentiful during June and the first part of July. Soon after emergence and feeding, eggs are deposited on the upper leaf surfaces, many being laid near the edges. After hatching, the larvæ mine the leaves until the latter part of August and September, at which time many leave the mines through the lower surface and drop to the soil where pupation takes place. Sometimes it is possible to find larvæ in their mines as late as the middle of October. The winter is evidently passed in the pupal stage, as a specimen under our observation pupated during the first part of October.

Egg of *B. ovatus*. Length 2.2 mm. Width 1.7 mm. Flat, oval, rounded at both ends. Side resting against leaf flat. Upper surface slightly convex. Chorion apparently smooth, shining. Transparent when first laid, later becoming yellowish white. Just before hatching larva can be seen through the transparent chorion, resting with the abdomen bent back sidewise upon itself the tip touching the second thoracic segment. Except for its smaller size, (Length 1.7 mm., width 1.1 mm.,) the egg of *B. aerosus* appears to be similar to that of *ovatus*.

In depositing the egg, the female protrudes the tip of the vagina slightly and rubs it back and forth against the leaf surface. This operation which ends in three or four minutes results in an oval, flat, transparent, watery-like mass, the outer surface of which soon hardens into a thin film or skin. The entire thing resembles an oval drop of transparent, watery excrement rather than an egg.

Of a pair of *B. ovatus* collected May 27 and placed in a cage, the female deposited sixteen eggs. A pair of *B. aerosus* collected at the same time and caged resulted in the female depositing forty-five eggs. Another pair of *aerosus* yielded thirty-five eggs. Inasmuch as no eggs were noted in the field when the specimens were collected, these numbers may be fairly representative. All of the above specimens lived and fed for six weeks, the eggs being deposited during the first four. All eggs were deposited on the upper leaf surface, many of them close to the edges. As a rule, leaves uninjured by adult feeding were selected. The young larva usually enters the leaf tissue directly beneath the egg and mines

either in an irregular area around the egg or in a gradually widening, elongate area away from the egg and parallel to and against the leaf edge.

Practically all of the *ovatus* eggs in our cages and many in the field were parasitized by *Closterocerus cinctipennis* Ash. In the cage containing forty-five *aerosus* eggs, nineteen mines were started, 17 eggs were parasitized and nine appeared to dry up. In the cage containing thirty-five *aerosus* eggs, ten mines were started, fifteen eggs were parasitized, and ten failed to hatch for some reason or another. Most of the larvæ which started the mines were also parasitized by the same species. Parasitized eggs became black in colour and many such were noted in the field. A few good eggs were noted as late as July 15, showing that egg deposition evidently extends over a considerable period.

Full grown larva of *B. ovatus*. Length 7 to 9 mm. Width of first thoracic segment 2.4 to 2.85 mm. Slightly wedge-shaped, much flattened. Body composed of thirteen well-defined segments which are deeply notched and lobed. Head and mouth-parts dark. Head more or less retracted into first segment. First segment as broad or slightly broader than the following, body gradually tapering to the twelfth segment. First segment with large, well-developed, comparatively smooth, shining, subquadrate plate on both dorsal and ventral surfaces. Dorsal plate with median line groove. Abdominal segments one to seven with pronounced rounded lobes. Lobes of abdominal segments five to nine each bearing a group of several stout, minute spines. Posterior dorsal edge of eighth abdominal segment fringed with row of minute, stout spines. Colour whitish, broad median dorsal line indicated on abdominal segments one to eight. Lateral dorsal portion of each body segment except the first varies from light gray in some specimens to black in others. (Immature specimens are entirely whitish). Entire dorsal surface except plate of first segment covered with somewhat slightly raised dots. These are more apparent laterally and bear the dark colour. Ventral surface somewhat similar to dorsal. Entire lateral surface of body sparsely hairy.

The larva of *B. aerosus* appears to be somewhat similar to the above, except that it is smaller (Length 4–5 mm. Width of first segment 1.53 mm.), and that the sides of the body appear to be slightly rougher, and the spines on the lobes of the fifth to ninth abdominal segments appear to be less pronounced.

Pupa of *B. ovatus*. Length 6.7 mm. Greatest width 3.5 mm. Colour brown ochre (Nomenclature of Windsor & Newton's Water Colours). Shape similar to that of the adult. Surface smooth, shining.

This stage is probably passed on top of the soil in rubbish or under the surface of the soil. Many mines were examined in the field, but no pupæ were ever found. It was noted that in every case, the larva had made its exit through the lower surface of the mine. In our cages only one larva of *ovatus* pupated, and it did so on the surface of the soil. When full grown they left the mines, and for some reason or another all except one died on the surface.

Ovatus was described by Weber in 1801 (Observ. Ent., Vol .1), and *aerosus* by Melsheimer in 1846 (Proc. Acad. Nat. Sc. Phila., Vol. 2). There is some synonymy indicated, but this need not be gone into here.

OAK LEAF SHOWING INCOMPLETE MINE OF *BRACHYS OVATUS*.

The dark oval spot near the lower edge of the mine is the dried egg shell.

NOTES ON THE NORTH AMERICAN SPECIES OF CORIZUS. (COREIDÆ, HETEROPTERA).

BY EDMUND H. GIBSON, U. S. BUREAU OF ENTOMOLOGY, WASHINGTON, D.C.

After several months of studying long series of specimens representing each species that occurs in North America and many exotic species the author comes to the conclusion that no satisfactory results, as to the limits of each species, the systematic arrangement and relation of species, can be obtained from the mere examination of dried adult specimens, especially without an increased biological knowledge of the group. The writer, therefore, is forced to call tentative any remarks or deductions herein set forth until they are verified by results obtained from life-history and habit studies of each species. At the outset of the study it was the plan to revise the genus, but being forced to abandon this because of the above stated reasons, this paper resolves itself into more or less of a review of Hambleton's* treatise of the North American species, which has been the most notable contribution to our knowledge of the group.

In the first place attention must be called to the great similarity of this genus to the Lygæid genus *Nysius* Dall., which has often been a stumbling block for young students and general collectors. In the mind of the author *Corizus* represents a much degraded group of Lygæidæ and should be considered in that family rather than the nucleus of a subfamily of Coreidæ, or else it is the group that links Coreidæ with Lygæidæ and is sufficiently different from both to be considered the basis of a separate family (Corizidæ L. & S.) The chief point of difference between *Corizus* and *Nysius* lies in the character and form of the genitalia of both sexes. Also *Corizus* may be distinguished from *Nysius* by the lack of a prominent osteolar canal and simplified odoriferous orifice and in the much more produced scutellum.

From all evidence at hand I agree with several other hemipterologists that subgenera should not be recognized and hence the names *Liorhyrsus* Stal., *Stictopleurus* Stal., and *Niesthrea* Spin. go into synonymy with *Corizus*.

The following artificial key is offered as an aid to the identification of the species with the hope that numerous dubious points in Hambleton's key will be cleared up.

Key to the Species.

1. Antenniferous tubercles very long, approximating the length of the first antennal segment ..... *tuberculatus* Hambl.
   Antenniferous tubercles more or less prominent, but not long or approximating the length of the first antennal segment 2
2. Posterior border of metapleura not prominently expanded laterally, lateral posterior angles broadly rounding and receding from margin of abdomen 3
   Posterior border of metapleura more or less expanded laterally, lateral posterior angles usually acute, sometimes rounding but never receding from margin of abdomen 4
3. Species large, connexivum spotted ..... *crassicornis* Linn.
   Species small, connexivum unspotted ..... *viridicatus* Uhl.

*The Genus Corizus with a review of the North and Middle American Species. J. C. Hambleton, Annals Ent. Soc. Am., Vol. 1, No. 1, pp. 133-152, 1908

4. Last segment of abdomen short, truncate in female and evenly rounded in male as viewed from above..... *hyalinus* Fabr.
   Last segment of abdomen comparatively long, rounded or pointed in female, not evenly rounded in male as viewed from above.....5
5. Scutellum broad at apex, rounded or blunt.....6
   Scutellum narrow at apex, pointed.....11
6. Abdomen above distinctly marked transversely with black, second and sixth segments light coloured..... *sidæ* Fabr.
   Abdomen not so marked.....7
7. Last dorsal abdominal segment of female long and distinctly angulate, apex less than a right angle. Dark coloured species. Sternum black, connexivum of male spotted.....8
   Last dorsal abdominal segment of female rounding, apex greater than a right angle.....9
8. Female segment very acutely pointed, extremely long. Western species..... *punctatus* Sign.
   Female segment not acutely pointed, Eastern species..... *bohemanii* Sign.
9. Species small, robust, and dark coloured, mottled on underside of abdomen. Very hairy. Connexivum heavily marked..... *parvicornis* Sign.
   Species larger, generally lighter coloured, not so hairy. Underside of abdomen not mottled. Connexivum only slightly marked if at all.....10
10. Species medium sized to small..... *lateralis* Say
    Species much larger..... *lateralis* var. *validus* Uhl.
11. Postero-lateral angle of metapleura greatly produced. Antennæ short, last joint comparatively stout. Wings not extending to end of abdomen. Species small and robust. Densely clothed with fine long hairs..... *hirtus* Bueno
    Not as above.....12
12. Sternum black. Small species..... *indentatus* Hambl.
    Sternum not black. Larger species..... *scutatus* Stal.

C. hyalinus Fabr. is a well-defined species and readily distinguished from all others by the shape of the last abdominal segment in both sexes. It is cosmopolitan in its distribution, and is the logotype of the genus. I am unable to separate by structural characters the various varieties as listed in Van Duzee's catalogue.

C. tuberculatus Hambl. should not be confused with any other species. The very greatly produced antenniferous tubercules serve to distinguish it. In general appearance it greatly resembles *indentatus* Hambl., *punctatus* Sign., and *bohemanii* Sign. This is a western species, records show it occurs from Washington and Idaho south through Oregon, Nevada and California.

C. hirtus Bueno is the smallest species in the genus, and appears to be somewhat of a degenerate form of *parvicornis* Sign. The elytra are usually much shortened and appear undeveloped. It is probably limited in its distribution to the northeast.

C. parvicornis Sign. But little needs to be remarked concerning this species, its short, stout, form being quite characteristic. It is known to occur in Washington, California, Arizona, New Mexico, Texas, and southward.

C. punctatus Sign. The greatly produced and acutely pointed last abdominal segment of the female serves as a character to set this off from other species. However, in this respect the females of *bohemanii* Sign. approach *punctatus*, and I am unable to separate the males of these two species. *C. punctatus* is limited to the southwest, while *bohemanii* occurs over the entire eastern half of the United States. While for the time being it is wise to keep these two forms distinct and as separate species, yet the author surmises that one may be a locality form of the other, and at some future time with increased evidence it may be best to consider one a variety of the other.

C. bohemanii Sign. is probably the most common species found in the East and Central States. Typical specimens are extremely dark in colour. The last abdominal segment of the female is produced more than any other species except *punctatus* Sign.

C. scutatus Stal. is the largest species in North America, and occurs from British Columbia south into Mexico. Its generally large size and bluntly pointed scutellum will serve to distinguish the species. In colour it varies considerably. Typical specimens are dark with connexivum heavily marked.

C. indentatus Hambl. is a comparatively small form that can only be separated from *scutatus* Stal. by its size and the fact that its sternum is black while that of *scutatus* is normally light-coloured. Both are western species.

C. sidæ Fabr. is very variable in size and general colour, but is readily separable from the other species by dorsal transverse, black bands or markings on the third, fourth and fifth abdominal segments. This characteristic colour marking is always present, although in some specimens examined it has become less prominent or faded. Numerous specimens exhibit much reddish coloration. Some authors would undoubtedly establish numerous varieties based upon variations of colour and size, but the writer is prone to believe that such differences come from climatic and food conditions. A close study of the external anatomy of these so-called forms reveals no structural differences. I do not agree to the advisability of considering *pictipes* Stal. a distinct variety. It is also a cosmopolitan species.

C. lateralis Say occurs over the entire United States and southward. There are no outstanding features that will readily serve to separate this from other species. The process of elimination in the determination of species will apply to advantage. If specimens in question cannot be placed in other species they are usually called *lateralis*. The acutely pointed scutellum and lack of markings on the connexivum are generally used as diagnostic characters. It is very variable in size and colour, some specimens being quite dark or reddish and others entirely pale yellow. I am unable to separate Uhler's *validus* from *lateralis*, except in size and the slight colour markings on the connexivum. However, I have seen innumerable gradations in size from an extra large, so-called *validus* to a minute *lateralis*, and have been unable to separate them by structural differences. Also even some nearly typical *lateralis* will exhibit slight indications of colour markings on the connexivum. For the time being I consider it advisable to consider *validus* as a variety of *lateralis* until more biological evidence is at hand.

C. crassicornis Linn. and *viridicatus* Uhl. These two species form a group quite distinct from all other species, and can be most easily recognized by the

fact that the posterior margin of the metapleura is nearly truncate, being only slightly sinuate. The posterior lateral angles of the metapleura are broadly rounded in these two forms, while in the other species they are more or less produced and not receding from the lateral margin of the abdomen. There are other characters, such as the transverse suture of the pronotum ending in a loop, which Hambleton gives for separating these species, but the author considers the difference in structure of the metapleura to be of the most importance. *C. viridicatus* is smaller and lighter coloured than *crassicornis*, and does not have the range of distribution that the latter has. With further biological data the writer suspicions that *viridicatus* will have to be considered a variety of *crassicornis*, or may even be forced into synonymy with the latter.

C. crassicornis occurs over the entire northern portion of the United States, and in the west it is known to extend north into Canada and south into Mexico, It also occurs in Europe and Asia. *Viridicatus* has been recorded only from Iowa, Nebraska, Wyoming, Utah, Nevada, Colorado and New Mexico.

The writer disagrees with Hambleton's opinion that "the nature of the dorsal sutures between the third and fourth, and fourth and fifth segments of the abdomen is quite constant." The advisability of using this character in the separation of species is certainly risky. The characters of the genitalia should only be used in the separation of but few species.

For a full description and complete bibliography of each species reference should be made to Hambleton's paper and to Van Duzee's recently published and most excellent catalogue.

In closing the writer wishes to acknowledge the generous loan of specimens from Messrs. H. G. Barber, J. R. Bueno, C. J. Drake, R. W. Leiby, W. L. McAtee, and Rev. M. Wirtner, all of which greatly facilitated the study which in turn permits these preliminary remarks. These collections with that of the National Museum afforded long series in each species.

A NEW RACE OF *PLEBEIUS ICARIOIDES* FROM VANCOUVER ISLAND.

BY WM. BARNES, M.D., AND J. McDUNNOUGH, PH.D., DECATUR, ILL.

This variable species seems to have developed on the southern portion of Vancouver Island into a local and very characteristic race which, on the underside, has so much similarity to *pheres* Bdv. from the San Francisco region that it has frequently passed under this name, and is probably figured by Holland in his Butterfly Book (Pl. XXX, Fig. 37) as this species.

The most characteristic feature of this new race, however, is found in the colour of the blue scaling of the upper side; this is a distinct silvery-blue, much as in *saepiolus*, and easily distinguished from the violet or lilac-blue of the other *icarioides* races; we have at various times had single specimens before us for examination, but this year through the efforts of Mr. E. H. Blackmore, of Victoria, B.C., we have secured a fine and, in general, very constant series of both sexes; we take much pleasure in dedicating this interesting form to its discoverer, and describe it in detail as follows:—

P. incarioides blackmorei *var. nov.*

♂. Upper side brilliant silvery-blue; primaries with a blackish border, 2 mm. broad, along outer margin; secondaries with vague dark marginal spots,

surrounding which the blue is of a somewhat paler colour than on the remainder of the wing; a small patch without blue scaling at costal angle; terminal dark line; fringes on both wings with basal half blackish and outer portion white, except along abdominal margin of secondaries where they are totally white. Beneath both wings pale gray, sprinkled with greenish at base and suffused with whitish rather broadly along outer margin; primaries with the dark discal dash and postmedian row of spots reduced in size as compared with those of typical *icarioides* (Sierra Nevada region) but broadly encircled with white; subterminal spots obsolete; secondaries with a white lunate discal mark and a curved postmedian row of rather obscure white spots, very faintly centered with black dots; traces of faint whitish subterminal lunules; fringes white.

♀. Upper side deep black-brown, basal half of primaries scaled with blue; a narrow, black discal mark; secondaries bluish at base and along abdominal margin; a narrow, broken, bluish line along outer margin, behind which are traces of dark spots similar to those of the ♂, partially outlined by blue scaling; no red scaling. Underside very similar to that of the ♂, with slightly darker ground colour. Expanse, ♂ and ♀, 30 mm.

Holotype.—1 ♂, Goldstream, Vanc. Is., B.C., (May 31). Coll. Barnes.

Allotype.—1 ♀., Goldstream, Vanc. Is., B.C., (May 31). Coll. Barnes.

Paratypes.—7 ♂'s, 5 ♀'s (same locality and date) in Coll. Barnes, and 7 ♂'s, 5 ♀'s in Coll. E. H. Blackmore, Victoria, B.C.

In the ♂ sex the variation of the upperside is inconsiderable, consisting in the greater or less width of the dark border of primaries and the degree of distinctness of the marginal spots of secondaries which may either become more or less suffused to form a complete border or be almost completely covered by the blue scaling; occasionally a black discal lunule is present on the primaries. In the ♀ the discal lunule is at times entirely silvered, approaching in this respect *pheres;* other specimens show a more or less complete row of subterminal bluish lunules on secondaries; in none of our specimens is there anything but the very faintest traces of the red submarginal shading so often seen in typical *icarioides*. Mr. Blackmore writes us that the food plant of the larva is *Lupinus columbianus* Heller, and that the race is localized to a small hill, 700 feet high, about three miles south of Goldstream.

ADDITION TO THE ODONATA OF FRANCONIA REGION, N.H.

In the Canadian Entomologist for January, 1919, (Vol. LI, 9-15) I published a list of the Odonata of the Franconia Region. Mrs. Slosson had been good enough to send me her complete list of Odonata collected at Franconia a decade or more ago, and her annotations were included in this paper save for the addition of three species inadvertently omitted by the printer. These bring the list to seventy-five species:

73. *Ophiogomphus rupinsulensis* (Walsh).

74. *Gomphus abbreviatus* Hagen.

75. *Tetragoneuria spinigera* Selys.

Mr. L. B. Woodruff has since the publication of the list sent me also a record of *Somatochlora elongata* (Scudd.) from Bretton Woods.

R. HEBER HOWE, JR.

Thoreau Museum of Natural History, Concord, Massachusetts.

A NEW JAPANESE SPECIES OF THE CYRTID GENUS OPSEBIUS.

BY F. R. COLE, BUREAU OF ENTOMOLOGY, FOREST GROVE, ORE.

In a collection of Cyrtidæ kindly loaned for study by the Entomology Department of Cornell University I found one specimen which was collected at Harima, Japan. The specimen belongs to the genus *Opsebius* and is an undescribed species. As far as I know this is the first Cyrtid recorded from Japan.

The genus *Opsebius* was described in 1856 by A. Costa from a species, *O. perspicillatus*, collected in Spain. In the following year Loew described *inflatus* from Spain, and not having seen Costa's paper erected for it the genus *Pithogaster*. In 1870 Loew described *O. pepo* from Spain, and in 1871 described *O. formosus* from the locality termed Gallia, probably southern France. The five other described species in the genus are all from the United States.

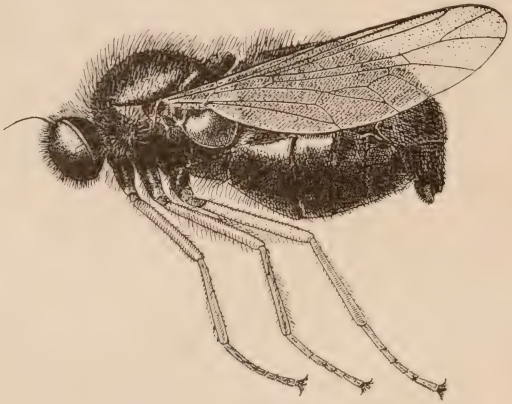

Fig. 13.—Opsebius nipponensis, n. sp.

The American species are uniformly blackish in body colour. In the three European species the body is black and yellow, and in the Japanese species described below the body colour is metallic green. All species of *Opsebius* have a characteristic cross-vein dividing the long cell above the discal. This cell may be an outer first basal or the first posterior. Loew left out this cross-vein in figuring the wing of *O. inflatus*, but Osten Sacken examined the type years afterward and found it to be present.

Opsebius nipponensis, n. sp.

♀. Eyes black with a purplish tinge. Head viewed from in front almost round. Eyes with long, dense black pile. Antennæ black with the long bristle-like arista characteristic of the genus. Occiput metallic green with long yellowish pile.

Thorax and scutellum metallic green with long, almost erect, yellowish pile. Ptero- and metapleuræ a bluish green, the upper pleuræ with yellowish pile. Squame semi-transparent and coloured a peculiar shade of brown, the rims yellowish.

Abdomen bronze green and clothed with a yellowish pile which is reclinate on the last four segments and thicker on the dorsum near the posterior margins of the segments. The abdomen is swollen in appearance and much larger than the thorax (broken at the base in this specimen). Venter much the same colour as the dorsum. Genitalia yellowish brown.

Legs honey yellow, the claws black. Wing membrane infuscated, darker toward the base. Veins blackish. Venation near the North American *O. diligens* O. S. Besides the characteristic outer cross-vein in the cell above the discal, there is a supernumerary cross-vein in one wing of this specimen just inside this vein. Length 8.5 mm.

Habitat.—One specimen collected at Harima, Japan, on May 19, 1916. The type is in the Cornell University collection.

A NEW SPECIES OF HYLEMYIA FROM CANADA (DIPTERA, ANTHOMYIIDÆ).

BY J. R. MALLOCH, F.E.S., URBANA, ILL.

The species described in this paper belongs to the genus Hylemyia, subgenus Pogonomyza S. and D. There are three other North American species of the subgenus known to the writer, all of which occur in the northeastern United States. The type specimen of the species described in this paper is in the Canadian National Collection of Insects, at Ottawa.

Hylemyia (Pogonomyza) spinosissima, sp. n.

Male.—Black, distinctly shining, entire body with rather dense, brownish gray pruinescence. Orbits, face, and cheeks with white, almost silvery, pruinescence; second antennal joint reddish yellow at apex. Thorax indistinctly vittate. Abdomen with a poorly defined dorso-central black vitta. Wing yellowish, veins pale. Calyptra and halteres yellow.

Head small; eyes separated by a little more than width of anterior ocellus; orbits sparsely bristled on almost their entire length; arista with dense, very short hairs; parafacial much narrower than third antennal joint; cheek not twice as high as width of parafacial; proboscis as thick as fore femur. Presutural acrostichals weak, 2-rowed; prealar bristle about one-third as long as the bristle behind it; sternopleurals 1:2 or 1:3; scutellum bare below. Abdomen narrow, parallel-sided, all dorsal segments with long, strong bristles on posterior margins and in a transverse series on disc; hypopygium of moderate size; fifth sternite with very short hairs. Fore tibia with from 2 to 4 bristles on antero-dorsal and on posterior surfaces; mid femur not much swollen, with a series of short bristles on entire antero-ventral surface, and 4 exclusively long, strong bristles on postero-ventral surface, the one furthest from base directed slightly apicad, situated at middle; mid tibia with 1 antero-dorsal, and 4 irregularly placed posterior bristles; hind femur with a series of bristles on antero-ventral surface, and another, weaker, series on basal half of postero-ventral surface; hind tibia with 4 or 5 strong antero-dorsal and 3 strong postero-dorsal bristles, the antero-ventral and posterior surfaces each with some setulose hairs. Costal thorn small; last sections of veins 3 and 4 subparallel.

Length 5.25 mm.

Type.—Port Hope, Ont., June 13, 1897, (W. Metcalfe).

This species is separable from its allies by the bristling of the mid femur, the postero-ventral bristles being much longer than in any of the other species, the longest at least twice as long as the femoral diameter.

A NEW SPECIES OF CŒNOSIA FROM CANADA (DIPTERA, ANTHOMYIIDÆ).

BY J. R. MALLOCH, F.E.S., URBANA, ILL.

The species described in this paper is one which was submitted for identification by the Dominion Entomologist. The type specimen is deposited in the National Collection of Insects, Department of Agriculture, Ottawa.

Cœnosia fuscifrons, sp. n.

Male.—Black, covered with dense white pruinescence. Head black, with white pruinescence except on interfrontalia; antennæ and palpi black; proboscis brown. Thorax and abdomen unmarked, apices of abdominal segments yellowish. Legs pale yellow, gradually darkened from near base of femora apicad, the tibiæ and tarsi usually fuscous, sometimes the bases of tibiæ pale. Wings white at bases, distinctly browned beyond to apices. Calyptra white. Halteres yellow.

Frons nearly twice as long as broad; orbits narrow, well defined, the bristles long, upper pair shorter than second and ocellars; antennæ reaching over two-thirds of the distance to mouth-margin, third joint slightly angulate at apex above; arista bare; parafacial in profile almost linear; cheek higher than width of third antennal joint, the margin with a few long, slender bristles. Humeral angle with one long and four or five short, stout bristles; presutural acrostichals in an irregular single or double series; intra-alar bristles weak; lower stigmatal bristle weak or absent, when present directed laterad or slightly upward. Abdomen short, cylindrical, dorsum with a few scattered setulose hairs; hypopygium small, retracted; fifth sternite with a large V-shaped excision, the processes short and broad. Legs long and slender, the bristles hair-like; basal joint of tarsi on all legs at least half as long as tibiæ; fore tibia with one median posterior bristle; mid tibia with the two median bristles very short, situated at about the same distance from base; hind tibia with the antero-ventral bristle very weak and short, the antero-dorsal and preapical dorsal bristles each over one-third as long as tibia. Inner cross-vein of wing below apex of first vein; third vein ending in apex of wing; apex of fourth basad of apex of third.

Length 2.25 mm.

Type.—Brockville, Ont., August 12, 1903, (W. Metcalfe). Paratypes, Ottawa, August 17, 1907, (J. Fletcher); Port Hope, Ont., May 14, 1897, (W. Metcalfe).

This species most closely resembles *argentate* Coquillett of the North American fauna, but may readily be separated from that species by the narrower frons and the colour of same, which is fuscous instead of silvery.

Mailed April 28th, 1919.

The Canadian Entomologist

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POPULAR AND PRACTICAL ENTOMOLOGY.

FRAGMENTS IN THE LIFE-HABITS OF MANITOBA INSECTS.

BY NORMAN CRIDDLE, DOMINION ENTOMOLOGICAL LABORATORY, TREESBANK, MAN.

Field work such as is carried on by the staff at an entomological laboratory naturally presents many opportunities for insect studies apart from the major problems for which the laboratories were primarily established. Thus the odd hours when more important matters are temporarily absent, or the less frequent occasions provided by the stops between trains, present opportunities for numerous minor studies resulting in the accumulation of various more or less disjointed notes which under ordinary circumstances remain unpublished. As such notes might well prove of interest to others, I have taken advantage of the Editor's request for an article to bring a few of them together under the above heading.

Pœcilopsis (Apochiema) rachelæ Hlst.

This moth has usually been considered rare but in reality is probably more numerous than is generally supposed. It appears quite early in the spring at the time when the first willows are flowering, though I have never observed it actually resting upon the flowers. It becomes active at the time when the beauties of sunset are darkening into twilight, and for that reason we christened it "the Twilight Moth." At that time the male moths may be seen flying in a jerky, up and down flight not unlike that of the buck moth (*Hemileuca*) and if we watch carefully, the hovering of the male over a certain spot will occasionally reveal the wingless female. The latter, however, is very difficult to find, and more often than not its discovery is due to accident rather than to search. The females have been found resting upon the ground, on the trunks of trees, or on the smaller twigs of shrubs such as willows. Aspen poplar appear to harbour them most frequently, possibly because the moth shows a wonderful colour resemblance to the bark. Willows, too, are often chosen for resting places, and here again the little bundle of fluff, of which the female moth reminds one, is very like a pussy willow.

The life-history of *Apochiema rachelæ* was described in the Canadian Entomologist by Mr. Arthur Gibson, Vol. XLV, No. 12, 1913, but the egg-laying habits, of which the strange ovipositor had occasioned considerable speculation, remained in some doubt at the time, and the observations which eventually filled the gaps have remained unpublished since 1915. In that year a female *Apochiema* was found running actively along the ground in broad daylight on April 13, having probably been disturbed by the building operations taking place close at hand. She was placed in a cage in which a goodly number of twigs, rotten wood, sods and other objects were added for ovipositing purposes. During the day time she remained quiet, but as the shades of evening approached she became active and was used to lure males within reach. Later it became evident that she was seeking a suitable situation for her eggs, and as she showed

little concern for the dimmed light of a lantern, I was able to watch her movements without in any way interfering with her work. Thus, she was seen to run actively about the cage, climb up and around the various twigs, and when a promising crack appeared test its possibilities with her ovipositor. Eventually reaching a dead twig containing loose bark she became greatly excited, and before long had thrust her ovipositor behind the bark between a crack and deposited an egg upon the wood beneath. Then moving to another spot she repeated the performance. Many of her efforts to reach a favourable situation were, however, without avail, and while she seemed to object strongly to placing more than one egg in the same place, the scarcity of appropriate cracks elsewhere invariably induced her to return to the original twig. It thus happened that while she searched over every object in the cage with great care her entire clutch of eggs was ultimately placed in the one twig. In all about 40 eggs were deposited. These, as was to be expected, were somewhat bunched though no egg actually rested upon another, and all were well hidden by the overhanging bark.

The foregoing observations provide strong evidence to show that the eggs of *Poecilopsis rachelæ* are not laid in masses as was previously supposed, but instead are deposited singly or at most in small numbers. They are placed beneath the dead loose bark, probably on those twigs so commonly found attached to the lower stems of aspen poplars or upon willows which provide many similar conditions.

This will, of course, explain why the larvæ are generally found singly and have a diversity of food plants. It also accounts for the remarkable agility of the female moth and the activity of the young caterpillars.

Eggs from the above-mentioned moth hatched on May 10–11, and moths from the resulting pupæ on April 20 of the following year. A majority of the adults were, as usual, females.

Leucobrephos brephoides Wlk.

The remarkable earliness at which this moth makes its appearance in springtime has often occasioned speculation as to whether or not it was able to force its way through the snow. The adults have frequently been observed flying and were captured too, while the woodlands still rested under a thick covering of snow and only the extreme uplands were free from its mantle. This seemed strong circumstantial evidence in favour of the supposition that the moths did make their way, though the small amount of visible land always left a doubt as to whether this was actually so or not. In 1916, however, evidence of a direct nature became available, which left no doubt as to the moth's habits in this respect.

The spring of 1916 was an unusually late one in Manitoba, while the winter preceding it had provided an abnormal amount of snow. Thus up to April 10 no land was visible anywhere, and the woodlands among which *L. brephoides* is known to breed presented a solid covering of approximately two feet in depth. Odd thaws had occurred, however, and once the temperature rose to 44° F. in the shade, so that the snow was actually in a thawing condition. The first moths were seen flying on April 1, and during the succeeding days were observed frequently up to the 10th, some of which we captured. As a rule these moths were noted resting upon bunches of straw, hay or some other material dropped

along the trails, and it was only on the warmer days that they appeared on the snow itself. One of these latter captures, however, presented unmistakable evidence of having recently emerged as it had not yet reached the state when active flight was possible, the wings being soft and not fully developed. It has been suggested that the larvæ of this moth might pupate in the dead, partly rotten wood as *Brephos infans* is supposed to do, and so perhaps lie above the snow line. Breeding experiments have failed, however, to show any indication of this. Moreover, the open woods in which *L. brephoides* breeds were in the above instance practically free from necessary dead material. Perhaps not the least interesting point in this moth's habits is the fact that it emerges when the temperature registers but a few degrees above freezing and while the ground upon which the pupæ rest must be very close to the freezing point. The moth, however, is thickly clothed with hairs which doubtless help to protect it from the cold.

Hemileuca lucina var. **latifascia** B. and McD.

This moth is by no means uncommon in the sand dunes near Aweme, Man. The handsome black and yellow caterpillars are at first found in bunches feeding upon the low shrubby aspen poplars and later as they attain maturity, scattered singly upon the same type of vegetation. They are often heavily parasitized and, in consequence, the moths only appear in large numbers at intervals of several years. The moth is an unusually handsome one, and its jerky, up and down flight, from whence it gets the name "buck moth," makes it an object of particular interest, flying as it does in broad daylight and during the finer days of autumn. For a long time we found difficulty in securing them. Then in a moment a secret was revealed to us whereby the males were collected with little effort. The moth is, of course, a day flier so that light traps are out of the question; yet, strange as it may seem, fire still provided the attractant, though in a totally different way. The means adopted to obtain the desired end were extremely simple and consisted of lighting a small fire from which sufficient smoke issued to drift "down wind" for about half a mile; in other words, to make a smudge of some dead grass and leaves. Then the collectors would calmly sit near and await the coming of the moths, nor were the latter long in appearing. A moth would be seen dodging backwards and forwards across the smoke as if seeking the strongest part of it, but at the same time steadily moving nearer to its source. Soon it was hovering over the fire and shortly after found a resting place in a convenient cyanide bottle. Others quickly followed, perhaps two or three at once, and the sport became fast and exciting. From what distance these moths came is unknown, but doubtless it was from as far as the smoke remained fresh. A bright, sunny day with a breeze sufficient to keep the smoke low provided the ideal conditions. We noted that these moths came towards the fire without hesitation, and that they invariably flew towards its source as if recognizing at once from whence it came. When actually over the fire they hesitated, hovered over it, and at times flew directly into the flames; on other occasions they recognized the heat sufficiently soon to enable them to "make off" before being injured.

From the fact that only males were enticed it would seem as if the smoke provided some odour or other attracting properties reminding the male of the opposite sex rather than of food. But whether this is so or not cannot

be definitely settled at the moment. The habit, however, provides an instance of how the males of this moth might be destroyed in large numbers were they ever to become a pest. Unfortunately the females are not attracted in this way, and it is on them after all that the perpetuation of the species depends most.

My brothers and I have since attempted to lure other insects by similar methods, but our efforts for a long time were without avail; indeed, so far as one could judge, most insects had a decided objection to the smoke. Later, however, we found that we had been actually associated with another insect that came persistently though doubtless from a very different motive from the *Hemileuca*. An account of this is given under the next heading.

Musca domestica Linn.

The common house-fly needs no introduction and it has been dealt with so frequently, both scientifically and popularly, that one can hardly expect to add much to what has already been written.

Our first experience with the house-fly as attracted to camp-fires was many years ago. We thought then that it was the savoury smell of a roasting grouse that induced the gathering, and I am not prepared to say even now that this was not, in part, the case. Later, however, we discovered that the flies came almost, if not quite, as readily when no cooking was in progress. But the climax was reached when we attempted to drive the pest from a building by smoking it out and after being forced out ourselves and permitting the smudge to modify, found to our astonishment that the flies were thicker than ever inside as if waiting a promised feast. It seemed to matter little where the fire was started, be it in the wilds far removed from habitations or close around the farm yard, the smoke no sooner had time to spread than along came a house-fly and soon a small procession was seen rapidly beating "up wind." Unlike the moth described above the flies did not fly directly into the fire, but instead seemed to use the smoke merely as a guide that led to other objects more attractive. Further observations convinced us that smoke constituted an invariable attractant for these insects. We also noted that a frequent method of entering a house, namely, by means of a chimney was only utilized when a fire provided the necessary smoke, and not to any noticeable extent when heat alone issued forth. Thus the contention that the attraction was in reality heat and not smoke, does not seem to be warranted from this evidence, and while the gathering of flies around screen doors and windows is doubtless, in part, due to warmth it may also be largely influenced by the smells from within, including smoke. Our experiments in the field, in which we provided a maximum quantity of smoke with a minimum amount of heat, in every way confirmed our previous observations as to smoke being the true cause of the attraction. It might be asked why should flies be drawn to smoke and follow it to its source. What does smoke usually foretell? A habitation or camp fire and these in their turn, man and food. Is it not possible that this reasoning acquired from long association with mankind, has become part of the fly's instinctive nature? It seems so to me, but I am content to let others judge. In any case, there are opportunities for some interesting experiments along the lines of this study which would seem well worth while.

Cicindela limbalis var. **awemeana** Casey.

This insect, in its adult state, is usually found on semi-moist roads, on similar moist areas along river banks or on pocket gopher hills in openings among semi-wooded areas. In autumn it seeks rather higher situations in which to hibernate. The larvæ occur in much the same places as the beetles, but are more easily discovered on the old gopher mounds that have become firm through the combined action of snow, rain and time.

In 1916, I came across a single gopher hill on quite high ground in which were no less than 16 burrows, most of which contained almost mature larvæ. These were marked for further observation and on August 8th dug up. The result showed 11 beetles about to emerge, 5 empty holes from which adults had issued, several parasite cocoons and a dead larva from which were coming numerous minute hymenopterous insects which were secured. These latter were afterwards determined by Mr. Girault, through the courtesy of Dr. Howard, as *Tetrastichus microrhopala* Ashm. There was also one living larva which would undoubtedly winter over and become a beetle the following year. Pupal cells were always either in, or very close to, the larval burrow and the average length of the two combined was three inches, while the deepest slightly exceeded four inches, and the shallowest two inches. The single larva had a burrow measuring four and a half inches, which represented the height of the gopher hill. This seems to be the usual depth even in winter time, as the larvæ, apparently, are unable to dig through the sod found below the mounds.

The beetles are also content with shallow winter burrows which seldom exceed a foot in depth.

Eleodes tricostata Say.

While investigating wireworms in grain fields during 1915, a new form of injury was noted which, in many respects, resembled the work of cutworms. This on close inspection, I traced to an active wireworm-like larva having indeed a close superficial resemblance to a true wireworm, but showing structural characters which placed it among the *Tenebrionidæ*. Specimens collected were about an inch in length, shiny, brownish-slate in colour above, with a blackish head, a light undersurface and a dark stripe along the ventral side. Pupation took place about August 18 and adults emerged the second week in September.

The habits of these *Eleodes* larvæ closely resemble those of ordinary cutworms, *Euxoa* spp. They appear above the ground at night, run actively about until they locate a suitable plant for food purposes, and then usually devour the leaves above ground, but at times, cut the stem off close to the surface. Their method of attack is generally told from that of cutworms by the plant being eaten above ground instead of being partly dragged under and eaten from below. The larvæ are very general feeders. In a wheat field they preferred lamb's quarters but ate wheat plants readily also. In captivity they feed upon various plants including red-root, pigweed, lambs' quarters, Russian thistle, tumble weed, Russian pigweed, wild buckwheat, hares-ear mustard, tumbling mustard, cabbage, turnip, beets, wheat, oats, barley and rye. It is also noteworthy that bran was consumed readily. Hence, there is reason to expect that the usual poisoned baits as used for cutworms would prove equally efficient in the control of this insect.

NOTES ON THE GENUS *OLENE* WITH DESCRIPTION OF A NEW SPECIES.

BY WM. BARNES, M.D., AND J. McDUNNOUGH, PH. D., DECATUR, ILL.

In our Contributions, Vol. IV, No. 2, p. 129, we called attention to two distinct species of *Olene* larva found in Maine; the one we identified as that of *vagans* B. & McD. and the other as *willingi* B. & McD. This latter identification was, however, an unfortunate error on our part; at the time we had only the single ♂ type of *willingi* before us, a rather suffused, poorly marked specimen, but later Prof. Willing was kind enough to send us for examination the co-type and the larva from which the figure in our revision of the genus (1913, Contr. II, (2), Pl. V, fig. 5) was made. These proved conclusively that our identification of the Maine larva as *willingi* was incorrect and that our treatment in the revision should hold. From information received from Mr. T. Spalding, of Provo, Utah, concerning the larva of *grisea* B. & McD., we believe that this name also for the present must remain associated with *vagans* as the two larvæ agree in lacking the dorsal hair pencil on segment XI; in any case *grisea* cannot be associated with the Maine species which we wrongly called *willingi*, the larva of this being at once separable by the presence of the aforesaid dorsal hair-pencil.

Mr. W. H. Brittain, Provincial Entomologist of Nova Scotia, is about to publish a Bulletin on the life-history of *vagans* which obviates the necessity for any further remarks on our part concerning this species.

During the summer of 1918 Dr. McDunnough was fortunate enough to discover eight more larvæ of the second *Olene* species on oak and beech trees in the vicinity of Ottawa, Ont.; these agreed exactly with the specimen found feeding on hazel the previous summer in Maine and eventually hatched out into three ♂'s and five ♀'s; the ♂'s agreed well with the Maine specimen figured in our Contributions, Vol. IV, Pl. XX, fig. 7; the ♀'s proved to be identical with our ♀ type of *vagans*, a fact which we had already hinted at in our notes (l. c. p. 129) when restricting the type of *vagans* to the ♂ specimen. As the species is without a name we offer the following description based on our Ottawa material.

Olene dorsipennata, sp. nov.

♂.—Head, thorax and primaries rather even, dull, greenish gray; a straight black basal half-line; t. a. line broadly geminate, angled outwardly slightly in the cell, strongly in the fold and again immediately above inner margin, the included space partially filled with brownish shading; reniform of the usual broad lunate shape, incompletely outlined in black with traces of white shading within and around the edges, but much less prominently than is usually found in the group; t. p. line irregularly dentate, slightly bulging opposite the cell and strongly angled inwardly above inner margin, followed by a diffuse, dull liver-brown subterminal shade which in turn is bordered outwardly by a poorly defined whitish shade, most prominent as a small, white patch above anal angle; an irregular terminal black line slightly interior to the outer edge of wing, especially at anal angle; fringes greenish-gray, faintly checkered outwardly with pale ochreous. Secondaries dark smoky with faint traces of a darker subterminal line. Beneath smoky gray, darker in cell of primaries with large discal dot and diffuse subterminal line on all wings. Expanse 37 mm.

♀.—Similar in coloration to the ♂ but with the brown shading before the t. a. line and beyond the t. p. line more prominent; the reniform is contained in a distinct white patch and the black terminal line is bordered inwardly with white. Expanse 50–55 mm.

Holotype.—1 ♂, Chelsea, Ottawa Co., Que. (July 8–14.)

Allotype.—1 ♂, Chelsea, Ottawa Co., Que. (July 8–14.)

Paratypes.—1♂, 2 ♀'s from same locality, and 1 ♂, 2 ♀'s from Aylmer, Que.; all in Coll. Barnes.

We have already noted (l. c. p. 129) the points by which this species may be separated from the very similar *vagans*, but we must confess that, without a knowledge of the larva, in many cases a definite identification is practically impossible. There is considerable variation in the species, especially in the ♀'s; these tend to show an indistinctness of maculation, combined with a diffusion of the pale shades, which gives a general washed-out appearance to the specimens and is quite characteristic of the species. As regards the larva we have nothing to add to the description we published under the name of *willingi* (Contr. IV, (2), p. 130); we have taken the caterpillars on oak, beech and hazel and have found the empty cocoons on poplar so that the range of food-plants appears to be wide.

Of the *Olene* species feeding on deciduous trees we now definitely know the larvæ of *meridionalis*, *vagans*, *leucophæa*, *atomaria* and *dorsipennata*. Of these *meridionalis* and *vagans* are very similar and it may be, when the connecting link, *basiflava*, from the Southern New England States is known, that these three forms will be regarded as races of one species rather than as distinct species. It should not be hard for some of our New England collectors to settle this question as the larvæ are quite readily found by searching the trunks of trees in the day time; in most instances they are partially concealed in crevices of the bark. Beating in the early morning or at dusk is also productive of good results, especially in a neighborhood where the species has been definitely located.

The following table may be used as a means of separation:

Larva entirely ochreous.....*leucophæa*.
Larva gray or brown
With lateral black hair pencils anteriorly only.....*atomaria*.
With lateral black hair pencils anteriorly and posteriorly
With long dorsal black hair pencil on Segment XI....*dorsipennata*.
Without hair pencil on Segment XI.
Dorsal tuft on Segment XI broad, brown; many black, plumed hairs from lateral tubercles.....*meridionalis*.
Dorsal tuft on Segment XI narrow, blackish; only one or two black plumed hairs from each lateral tubercle.....*vagans*.

Concerning the pine-feeding Olenes Dr. McDunnough was successful in securing a number of the larvæ of *plagiata* by searching pine trunks in the vicinity of Ottawa the last week in May; they were then full grown, pupating in about a week and producing the adults in early June. Mr. J. M. Swaine, of the Entomological Branch, Ottawa, brought in two young larvæ of the same species in June, obtained by beating young pine trees in the vicinity of Ft. Coulonge on the Ottawa River; one of these fed up and produced the adult in August;

the other hibernated half-grown, and is at the time of writing commencing to feed again. It is evident that at least a certain proportion of the larvæ hibernate twice; in the case before us this took place in a slight web uniting two or three pine needles to form more or less of a protective covering; whether this is the natural method or whether the larva descends to the ground ordinarily is unknown to us.

Plagiata larva is gray with a decided yellowish tinge; the dorsal tufts on abdominal segments 1–4 and 8 are deeper mouse gray, intermingled with plumed white hairs; there are also lateral black hair pencils anteriorly and posteriorly as well as a single dorsal pencil arising out of the tuft on the 8th abdominal segment; the dorsal tubercles on the remaining segments show a rosette of short plumed white hairs and a number of longer slightly barbed yellowish hairs; the supra- and subspiracular rows of tubercles are very similar but contain in addition a single (occasionally two) long black plumed hair. Subventrally there is a fairly heavy clothing of long whitish, bipectinate hairs; the eversible dorsal glands are coral red.

Judging by the description given by Dr. Dyar of the larva of *pini* (1911 Proc. Ent. Soc. Wash., XIII, p. 19) the two must be very closely allied and may even be identical; however, as we have had no opportunity for a careful examination of either the larvæ or the adults of Dr. Dyar's species the two names may stand for the present as given in our Check List.

KIRBY'S INSECTA: VOL. IV FAUNA BOREALI-AMERICANA. RESTRICTION OF AN INDEFINITE LOCALITY.

BY ALBERT F. WINN, WESTMOUNT, QUE.

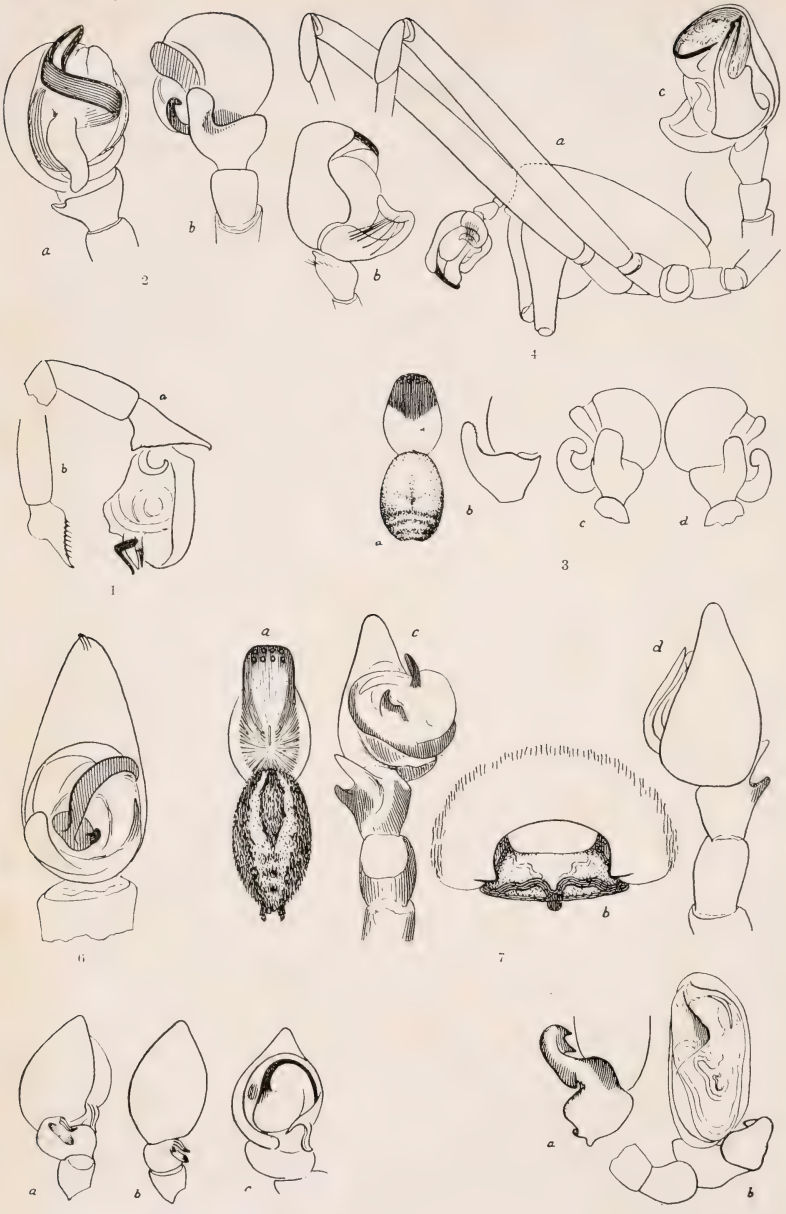
Anyone who has occasion to consult this volume about Canadian Insects can hardly fail to notice the oft-recurring words "Taken in Canada by Dr. Bigsby," and will probably lay the book down wishing that the author had been more definite in quoting localities. While Canada in 1837 was of a very limited area compared with our country at the present day, it was of large extent.

Some months ago, having an enquiry as to what part of Canada, in my opinion, the types of a species of butterfly described in this volume probably came from, I tried to get a little light on the subject. The introduction to the work conveys nothing further than acknowledgement and thanks to Dr. Bigsby, of Newark, and Capt. Shepherd, of the Royal Artillery, for records for Canada, and to Dr. McCulloch and Capt. Hull for those of Nova Scotia.

In the Redpath Library of McGill University, however, there are three books by Dr. Bigsby. In one of these, entitled, "The Shoe and Canoe," by John (Jeremiah) Bigsby, D.D., late Secretary to the Boundary Commission, published in London 1831, I find the following: "Both my duty and my pleasure took me out of the common track————to Lakes Simcoe, Huron, Superior, etc., into a portion of Hudson's Bay and up the River Ottawa into Lake Nipissing as well as to the rarely visited Highlands of the St. Lawrence below Quebec."

It would seem safe to limit the locality "Canada" to the districts above mentioned, and wide though they still are, all are within the present boundaries of the Provinces of Quebec and Ontario.

May, 1919



SPIDERS FROM CANADA AND ADJOINING STATES.

NEW SPIDERS FROM CANADA AND THE ADJOINING STATES, No. 2.

BY J. H. EMERTON, BOSTON, MASS.

The first paper of this series was published in August, 1917, and described a number of spiders from the Pacific coast, eastern Canada and northern New York and New England, part of them collected in the summer of 1916. The present paper describes a few new species collected and identified from the same parts of the country since 1916. In addition to the new species, the male of *Pardosa vancouveri*, described in the paper of 1917, has been found, and its palpus is now figured. *Diplostyla canadensis* Emerton, described in Trans. Conn. Acad., 1882, from Montreal, has been again found, at Lake Tear on Mt. Marcy in the Adirondacks, N.Y., at an elevation of 4,500 feet.

Lophocarenum minakianum, n. sp.

Hardly 2 mm. long. Light brown with the legs and palpi and underside of the abdomen pale. The whole upper half of the abdomen is thickened and covered with small depressions in which are minute hairs. The head of the male has a hump which carries the posterior middle eyes. It is about as high as wide, and rises abruptly before and behind. It is rounded on top and has a slight groove in the middle, but is not as deeply divided as in *L. sculptum* Em., (Can. Ent., Aug., 1917,) which this species closely resembles. At each side of the hump is a deep groove as in *sculptum* and *excavatum*. The male palpus is much like that of *sculptum*, but the process on the top of the tarsus is longer and more narrowly pointed. (Pl. 7, Fig. 1, a and b.)

Minaki, Ontario. Sifted from leaf mould near Minaki Inn.

Ceratinopsis obscurus, n. sp.

Male 2 mm. long. Legs and cephalothorax yellow brown and the abdomen dark grey. The cephalothorax is nearly as wide as long and narrowed in front. The male palpi resemble those of *C. nigripalpis*, but the outer process of the tibia is wide and flat. The tarsus has, as in *nigripalpis*, a wide, thick ridge on the outer edge, at the side of which is a narrower groove. The palpal organ resembles that of *nigripalpis* and *nigriceps*. (Pl. 7, Fig. 2, a, b.)

In leaf mould in pine and birch woods at Minaki, Ontario.

Grammonata semipallida, n. sp.

Scarcely 2 mm. long. Legs pale, cephalothorax but little narrowed in front, pale on the hinder half and darker gray in front. The palpi are also dark grey. The abdomen is gray, pale in front and marked behind with alternate dark and light transverse spots. (Pl. 7, Fig. 3, a.) The male palpi are large and the tarsus round. The tibia has a short, blunt process extending over the tarsus, which has a distinct groove in which the process fits. The tarsal hook is curved in a half circle. The tube of the palpal organ is slender and abruptly curved backward in the middle. (Pl. 7, Figs. 3, b, c, d.)

Winnipeg, Manitoba, June, 1917. F. W. Waugh.

Diplostyla crosbyi, n. sp.

Male 4 mm. long. First femur 3 mm. Height of head and mandibles nearly equal to length of cephalothorax. (Pl. 7, Fig. 4, a.) The cephalothorax and legs are brown and the abdomen gray with light markings in pairs, as in *nigrina*. The tarsus of the male palpus is but little longer than wide. The tarsal hook has a sharp angle near the end and the terminal part is thin and flat and curved,

as if to fit against the convex side of the palpal organ. Near the base of the tarsal hook are several long hairs. The basal process of the palpal organ is not as straight as in *nigrina*, but is turned a little inward, as in *inornata*, (Pl.7, Fig. 4, b, c) and the narrow terminal half is flattened and slightly grooved in the middle.

Sifted from moss at 3,500 feet near the mouth of Uphill Brook, near Mt. Marcy, in the Adirondacks, N.Y. One male only.

Dictyna quadrispinosa, n. sp.

Male 2 mm. long. Colours and markings like *muraria*. The male palpi have the tibia wider than long. The usual two spines are sessile at the front edge of the tibia on the outer side, they are close together and curved down from the base and upward at the points. Behind the two spines is a ridge somewhat longer than the spines, ending in blunt points above and below.a (Pl. 7, Fig. 5, a, b.) The palpal organ is smaller than in *muraria*, and the tube and its supports more slender. (Pl. 7, Fig. 5, c.)

Black Brook, Clinton Co., N.Y., June, 1916. C. R. Crosby.

Pardosa vancouveri Emerton, Can. Ent., Aug, 1917.

The original description was of the female only, the male has since been found and resembles the female in size, colour and markings, with slightly longer legs and smaller abdomen. The male palpus (Pl. 7 Fig. 6) has the basal process very long and flattened and curved obliquely across the palpal organ. The whole palpus is very dark coloured and the details hard to see.

Near Lytton, B.C., from W. Taylor, Vancouver.

Amaurobius agelenoides, n. sp.

Female 9 mm. long. Male a little shorter and more slender. Colours pale yellow and brown in a distinct pattern on the back. The cephalothorax is brown with pale lateral stripes and a pale middle stripe half as wide as the head extending from the eyes to the dorsal groove. (Pl. 7, Fig. 1 a) The legs are pale with fine, dark hairs. The abdomen has a pale middle stripe divided in two in the front half and broken by several indistinct, dark middle spots behind. The rest of the abdomen is brown above and below without any other distinct markings. The upper spinnerets are twice as long as the lower pair, with the terminal joint conical and as wide as long. The cribellum is two-thirds as wide as the lower spinnerets and distinctly divided across the middle. The calamistrum is three-fourths as long as the fourth metatarsus, but does not show at all in the male, which also has the cribellum narrower and less easily seen than in the female. The epigynum is more open than in *sylvestris* and *pictus*, the middle lobe wide and dark coloured. (Pl. 7, Fig. 2 b.) The male palpus has two processes on the outer side of the tibia, which show best when seen from below. (Pl. 7,Figs. c, d.) The tarsus is twice as long as wide, widest near the base, and nearly straight on the inner side. (Pl. 7,Fig. d.)

Immature individuals have long been known, but only in the summer of 1918 were adults secured, the male by C. G. Hewitt at Jasper, and the female by N. B. Sanson at Banff.

Clubiona furcata, n. sp.

Male 4 mm. long. Pale with the abdomen reddish in alcohol. The size, eye arrangement, and length of legs resemble *C. abboti*. The male palpus has the tibia short with the long, outer process curved downward and outward with

a short fork at the end. (Pl. 7, Figs. 7, a.) The palpal organ, (Pl. 7, Figs. 7, b), is long and somewhat like that of *C. canadensis*.

Saskatoon, T. N. Willing.

Clubiona saltitans, n. sp.

Male 3 mm. long. Female 3.5 mm. Cephalothorax 1.5 mm. Colour pale, less red in alcohol than *C. abboti*. Eyes of the upper row in line with the front row and covering the whole width of the head. (Figs. 14, d.) Length of mandibles equal to width of head and slightly longer than in *abboti*. The male palpus resembles that of *abboti*, but is more slender and the outer process of the tibia has the lower branch one-half longer than the upper. (Figs. 14, a, b.) It has been found at several places near the seashore under stones and sticks on the sand. It sometimes jumps when pursued.

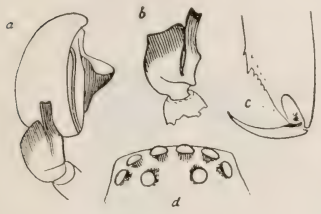


Fig. 14

This species has been confused with *C. abboti*. In general it is slightly larger, paler and more slender, and the tarsus of the male palpus is distinctly smaller. The mandibles are slightly longer, but the arrangement of the teeth is the same in both species. (Figs. 14, c.)

Ipswich, Plum Island and Wellfleet, Massachusetts.

Xysticus acquiescens, n. sp.

Male 5.5 mm. long. Legs very short, the first and second pairs 7 mm. long. The general colour is brown, the first legs a little darker and the palpi lighter than the rest. The cephalothorax has the light middle stripe much darkened with brown in the front half. The abdomen has the usual markings in pairs, the hinder pairs united into transverse stripes. (Pl. 7, Figs. 1, a.) The first and

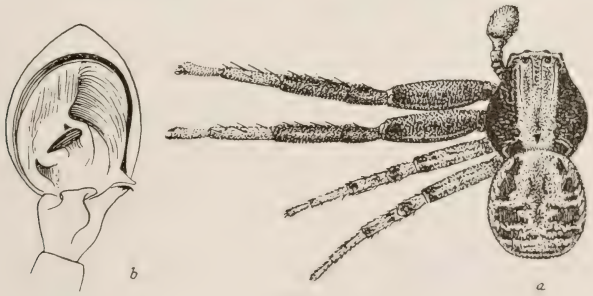


Fig. 15

second legs have the femur, patella and tibia darkly spotted with brown, and the tarsus and metatarsus a little lighter. The male palpus has the two processes of the palpal organ both small, the basal one simple and the distal one narrow at the base and thickened at the end where it curves toward the other. In front of the two processes is a wide, dark brown ridge. (Fig. 15, b.)

Saskatoon, T. N. Willing.

Xysticus ontariensis, n. sp.

Male 4 mm. long. First and second legs 9 mm. Cephalothorax dark brown, showing a middle stripe very indistinctly. The first and second legs have the femur and patella dark brown, and the rest of the leg pale. The third and fourth legs are spotted as usual but not very strongly marked. The abdomen has

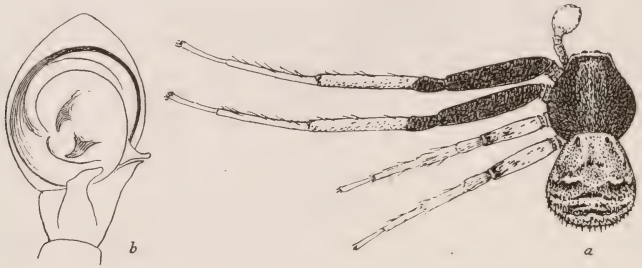


Fig. 16

two irregular brown patches on the front half, and three or four transverse stripes behind all with irregular outlines and variable colour. (Fig. 16, a.) The male palpus has the tibia white. The palpal organ has the two processes on the under side, simple hooks turned toward each other as in *X. gulosus*, with which this species has been confused. (Fig. 16, b.)

Cloyne, Ontario, A. B. Klugh; Wellesley, Massachusetts.

NOTES ON COCCIDÆ—III. (HEMIPTERA).*

BY G. F. FERRIS, STANFORD UNIVERSITY, CALIFORNIA.

Continued from Can. Ent., vol. 50, p. 332.

Genus **Stigmacoccus** Hempel.

1903. Fernald, Cat. Coccidæ, p. 20.

Monophleboid Coccidæ in which the adult female possesses mouth-parts, legs and antennæ, the latter 7 8-segmented; immature stages without legs and with the antennæ reduced to mere chitinized points, with an anal tube formed by the chitinization of the posterior portion of the alimentary canal, this tube terminating at its inner extremity in a series of tentacle-like processes. Abdomen in adult and penultimate stages with 8 pairs of spiracles.

Type of the genus, *Stigmacoccus asper* Hempel.

Notes.—The original description of the type species was based upon the adult alone and the immature stages have not been described. In general the genus appears to be quite similar to *Xylococcus*, but the very peculiar character of the anal tube alone seems sufficient grounds for its separation.

Whether the genus *Perissopneumon* Newstead is a synonym of *Stigmacoccus*, as Cockerell has indicated, is perhaps doubtful.

Stigmacoccus asper Hempel.

Fig. 17.

Penultimate stage. Enclosed in a test, as described by Hempel for the adult female. Body more or less spherical, with the anal opening high up on the dorsum. Derm membranous throughout, except for a small, circular,

chitinized area surrounding the base of the anal tube, everywhere beset with small, spike-like spines. Legs lacking. Antennæ reduced to mere chitinized points. Anal tube of a very distinctive type (Fig. 17A), its inner end terminating in a series of tentacle-like processes (in my single specimen 7 in number), these processes and the tube itself thickly beset with pores. Dermal pores of three types. Of these, one (Fig. 17B) is more or less 8-shaped, with one of the loculi

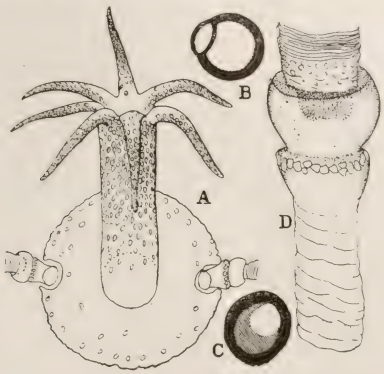


Fig. 17.—*Stigmacoccus asper* Hempel. A, anal tube, with chitinized area and spiracles at its base; B, 8-shaped pore; C, simple pore, from clusters about spiracles; D, spiracle, external opening at lower end.

much smaller than the other. Another resembles the first in shape, but is much smaller and is borne at the inner end of a short duct. The third (Fig. 17C) appears as a simple ring with the enclosed area partially chitinized. The pores of the last type form clusters about the spiracles; those of the first two types are scattered about over the body. Eight pairs of abdominal spiracles present, all of the type indicated in Fig. 17D. The last abdominal pair are situated at the edge of the circular, chitinized area which surrounds the base of the anal tube.

Material examined. Part of the type material, this including a single immature individual.

Genus **Xylococcus** Loew.

1903. Fernald, Cat. Coccidæ, p. 32.

1917. Florence, Ann. Ent. Soc. Am., vol. 10, p. 147.

This genus has been assigned by previous authors to the subfamily Margarodinæ because of the supposed absence of mouth-parts in the adult female. I have at hand a series of adult females of *X. macrocarpæ* Coleman, and in this series practically every stage from a complete absence of mouth-parts to mouth-parts which are to all appearances functional is represented. It appears from this series that the foundations of the mouth-parts are probably always present, but that in some instances they do not become chitinized.

I have not observed mouth-parts in the adult females of other species of *Xylococcus*, but the number of specimens examined is small, and it is not at all improbable that the examination of a long series would reveal conditions similar to those found in *X. macrocarpæ*.

It is becoming increasingly evident that the distinction heretofore drawn

between the Monophlebinæ and the Margarodinæ on the basis of the presence or absence of the mouth-parts in the adult female cannot be maintained.

Xylococcus betulæ Perg.

1898. *Xylococcus betulæ* Pergande, U. S. Dept. Agric., Div. Ent., Bull. 18, n. s., p. 18.

1917. *Xylococcus alni* Florence, Ann. Ent. Soc. Am., vol. 10, p. 158.

There is, I think, no question that these two species are identical. I have at hand the types of *X. alni* and specimens of *X. betulæ* as follows: from "cherry birch," Port Colborne, Ontario, Canada, adult female, intermediate stages and larva; from beech, Ithaca, N.Y., intermediate stages; from beech, Michigan, adult female, intermediate stages and larva.

The characters used by Miss Florence for the separation of *X. alni* are hardly sufficient. The differences in the anal tube of the apodous stages are not constant. The first larval stage of *alni* (in the two specimens examined) has 6–7 median ventral pores and the first stage of *betulæ* (in numerous specimens) has but 5, but in all other respects the two are identical.

Whether *X. quercus* is distinct is questionable. There appear to be certain differences in the first stage, but if these differences be allowed as of specific value it will be necessary to name another species for specimens taken from *Quercus californicus*. More material is desirable before forming any conclusions.

X. macrocarpæ Coleman is very distinct. I would separate this from *X. betulæ* by the following characters:

Adult female with the derm of the dorsum practically destitute of spines; anal tube of apodous stages with pores at the inner end only; marginal pores of first stage sessile, *X. macrocarpæ* Coleman.

Adult female of the dorsum everywhere quite thickly beset with slender spines; anal tube of apodous stages with pores both at the inner end and near the base; marginal pores of first stage borne at the inner end of short ducts.....*X. betulæ* Pergande.

Genus **Kuwania** Ckll.

1903. Fernald, Cat. Coccidæ, p. 30.

1909. Cockerell, Can. Ent., vol. 41, p. 56.

Monophleboid Coccidæ in which the adult female appears normally to lack mouth-parts but with the legs and antennæ present; tarsal claw without digitules, the tibia with numerous digitule-like hairs on the inner side at its apex; intermediate stages without legs and with the antennæ reduced to mere chitinized points, anal tube lacking. Four pairs of abdominal spiracles present in adult and penultimate stages, these on the anterior segments of the abdomen.

Type of the genus *Kuwania quercus* (Kuwana).

Notes.—I am inclined to doubt that *K. zeylanica* (Green) is congeneric with *K. quercus*. The immature stages have not been described, and it is upon these that the matter will largely depend, the adults of all of these forms being quite similar. I have at hand an adult female of *K. zeylanica* which differs from the same stage of *K. quercus* in having well-developed mouth-parts with a distinct mentum, and in having 6-8 pairs of abdominal spiracles.

Kuwania quercus (Kuwana).

Fig. 18

1903. Fernald, Cat. Coccidæ, p. 30..

1917. Ferris, Can. Ent., vol. 49, p. 377, fig. 39b.

The general characteristics of the adult female have been described by Kuwana, but there remain certain points of interest. The mouth-parts appear really to be lacking as they are absent in all of numerous preparations examined It is not impossible, however, that further examination would reveal a condition similar to that found in *Xylococcus macrocarpæ*.

There are four pairs of abdominal spiracles (not noted by Kuwana), these of the type shown in Fig. 18. D.

Penultimate stage. Oval in form (Fig. 18C). Antennæ reduced to more chitinized points. Spiracles arranged as in the adult but of a quite different

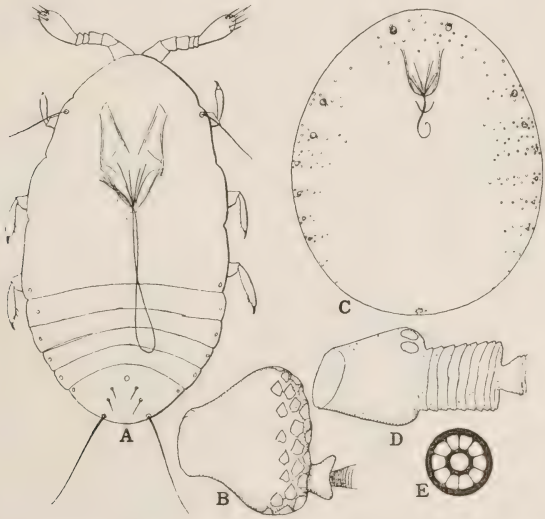


Fig. 18.—*Kuwanta quercus* (Kuwana). A, larva; B, spiracle of apodous stage C, apodous stage; D, spiracle of adult; E, pore of apodous stage.

form (Fig. 18B). Margins of the body with large, circular pores (Fig. 18E), these most numerous toward the head. Anal opening simple, without an anal tube.

First stage larva. (Fig. 18A). The description given by Kuwana appears to be accurate except for the statement, "Margins of the body with capitate hairs." These hairs do not appear in my specimens. The larva is so minute that I have been unable to detect the arrangement of the spiracles, or, indeed, whether or not they are present. Each abdominal segment bears at the margin a small object that may be either a pore or a spiracle.

Material examined. Preparations from the type material.

Genus **Cissococcus** Ckll.

Coccidæ referable to the subfamily Coccinæ. Adult female with the anal plates borne at the apex of a low prominence, their dorsal surface beset with numerous small spines; antennæ and legs present but extremely small; stigmatic depressions apparently lacking, their presence not indicated by differentiated spines. First stage larva likewise without differentiated stigmatic spines.

Type of the genus *Cissococcus fulleri* Ckll.

Notes.—The original description of this genus is much in error. The author states, "Belongs to the Eriococcini. *Larva* typically Eriococcine, with rows of dorsal spines. . . *Adult* . . . with a pair of plates simulating those of the Lecaniinæ." The larva is in all respects of the type usual in the Coccinæ (=Lecaniinæ) and is entirely without dorsal spines. The anal plates of the adult are very much of the type seen in *Ceroplastes*, except for the numerous spines on the dorsal surface. In spite of the gall-making habit the genus is indeed possibly close to *Ceroplastes*.

The species described by Ehrhorn as *Cissococcus ? oahuensis* has nothing to do with *C. fulleri* and has quite properly been referred by its author to a new genus.

Cissococcus fulleri Ckll.

Fig. 19.

My single adult specimen is not in sufficiently good condition to permit adding much to the description already given for the genus. The anal plates (Fig. 3C) are rather long, the lateral margin rounded, the tips quite pointed, resembling in this respect the type of plates seen in Ceroplastes. There appear

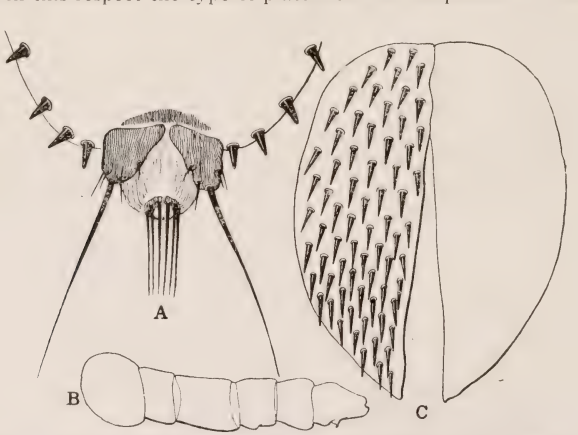


Fig. 19.—*Cissococcus fulleri* Ckll. A, posterior extremity of abdomen of larva, showing the eversible anal tube, which is characteristic of the Coccinae; B, antennæ of larva, setæ not indicated; C, anal plates of adult, spines of dorsal surface indicated in but one plate.

to be no marginal spines. The antennæ are extremely minute, with the number of segments undeterminable; the legs are likewise very small but possess the normal parts.

The first stage larva bears a marginal series of short, stout spines (Fig.

19A); the antennæ are 6-segmented, rather short and stout; there are no dorsal spines.

Material examined. Part of the type material.

Corrections to Earlier Papers.

In my description of *Stomacoccus platani* (2) the caption for Fig. 38B has been omitted. This is the antenna of the prepupa of the male. On page 376 it is stated that the antennæ of the prepupa of the male are 8-segmented, while the figure shows 9 segments. The figure is correct.

In the redescription of *Cryptokermes brasiliensis* Hempel (3), the second line on page 222 reads in part, "posterior portion of anal ring." This should read, "posterior portion of alimentary canal."

*THREE NEW SPECIES OF BRACONIDÆ.

BY C. F. W. MUESEBECK, ITHACA, N.Y.

Apanteles phigaliæ, n. sp.

Female.—Length 2.2 mm. Black, shining. Head transverse, broad; mandibles reddish brown; palpi yellowish; face slightly convex, medially punctate, and with a distinct median ridge originating between the antennæ; antennæ black. Mesoscutum closely punctate; scutellum distinctly but shallowly punctate, slightly convex; both mesoscutum and scutellum shining. Mesopleura punctate cephalad and ventrad, and with a large, shallow, perfectly smooth and highly-polished area posteriorly, which does not possess the crenulate fovea common to many species of the genus. Propodeum smooth and shining, with a number of short radiating striulæ extending upward from the middle of the posterior margin; no median carina nor median fovea present.

Wings.—Tegulæ and wing-bases black; veins and stigma brown; radius and transverse cubitus meeting in a sharp angle, with a distinct heel at the point of union, the two veins about equal in length. Legs.—All coxæ black, the posterior rather smooth, above with a basal elongate-oval flattened shining area, which has a few scattered punctures; all trochanters dusky; fore and middle femora somewhat dusky at extreme base, the hind femora dusky at extreme base and apex and along the upper edge, the hind tibiæ dusky at apex, and the hind tarsi, except on the basal two-thirds of the basal segment, entirely dusky.

Abdomen black and shining, moderately broad; first tergite almost twice as long as broad at base, parallel-sided, and rounded off very strongly at apex so that apex is much narrower than base, almost entirely smooth and polished, only the extreme apex being weakly punctate; plate of second dorsal segment triangular, very narrow at base, and three times as broad as apex as at base, three-fourths as long down the middle as broad at apex, and very slightly, or not at all, shorter than the third plate; the basal middle of this plate is smooth and polished, while the apical margin and the apical angles are finely rugulose. The membranous margins along the apical half of the first tergite and all of the second are fuscous, and exceedingly broad along the second plate, the mem-

2. Canadian Entomologist, vol. 49, p. 375-378, figs. 36 to 39, (1917)
3. Canadian Entomologist, vol. 50, p. 221-225, (1918)

*Contributions from the Gipsy Moth Laboratory, United States Bureau of Entomology, Melrose, Highlands, Mass.

branous portion on either side of this plate being almost as large as the plate itself. Segment three and beyond smooth and shining. Ovipositor subexserted.

Male.—Like the female except for the usual sexual differences.

Type locality.—Melrose Highlands, Mass.

Type.—Gip. Moth Lab. No. 12007N-16. Deposited in U. S. Nat. Mus. Type No. 22095 U. S. N. M.

Host.—Phigalia titea Cram.

Described from 21 specimens (13 females; 8 males) bred by Mr. R. T. Webber, of the Bureau of Entomology, at the Gipsy Moth Laboratory, Melrose Highlands, Mass., from nearly full-grown larvæ of the above species, June, 1916, the adult parasites issuing the following spring.

Cocoons are light brown in colour, parchment-like, and have about eight strong, regular, longitudinal ridges; they are broader at the anterior end and taper considerably toward the posterior end; they resemble somewhat the cocoons of some species of the closely-allied genus *Microplitis* Foerst., especially those of *M. gortynæ* Riley, but are much smaller. Although this species of Apanteles is gregarious the cocoons are not fastened together, but are formed individually on the back of the caterpillar.

The species resembles somewhat *Apanteles feltiæ* Vier., but differs as well in the paler stigma and lighter legs as in the second abdominal tergite being considerably longer in proportion to its width at the apex.

Apanteles compressus, n. sp.

Female.—Length 2 mm. Black, shining. Head transverse; face punctate, slightly broader than long; palpi yellowish white; antennæ yellowish-brown on scape and basal third of flagellum, darker on apical two-thirds; apical flagellar segments of antennæ broad, almost as broad as long and broader than the basal segments. Mesoscutum and scutellum closely punctate, the latter somewhat less so medially, only slightly shining; scutellum narrow, distinctly longer than broad at base, very slightly convex. Mesopleura punctate and dull anteriorly and below, smooth and polished above and posteriorly, where there is a long, narrow, finely crenulate, longitudinal channel. Propodeum very finely rugose, the posterior angles deeply sunken and shining; a very weak suggestion of a median carina on the propodeum.

Wings.—Tegulæ and wing-bases black; stigma and veins brown; radius and transverse cubitus forming a rather uniform arc, without the sharp angulation at the point of union as found in many species of the genus. Legs.—Fore and middle legs entirely yellowish; hind coxæ black, smooth and shining, having only a few distinct punctures at base above; hind trochanters and femora yellow, except the upper edge of the femora dusky on the apical two-thirds; hind tibiæ blackish except on basal fourth, where they are yellowish; hind tarsi dusky except at base of basal segment; spurs of the hind tibiæ not one-half as long as the metatarsus.

Abdomen black, shining; very narrow, being greatly compressed at apex; first tergite long, narrow and parallel-sided, twice as long as wide at base and narrower at apex than at base, very finely rugulose, feebly striate at extreme sides; second tergite triangular, only one-half as broad at base as long down the middle, and three times as broad at apex as at base, almost entirely smooth and polished, only the apical angles finely rugulose, this rugosity extending toward

middle along the margin; membranous margins along apical third of first plate and all of the second, broad, dark testaceous; third tergite and beyond very smooth and shining; ovipositor subexserted.

Males.—Agrees well with the female except for the usual sexual differences.

Type locality.—Lunenburg, Mass. Cocoon mass with the host larva firmly attached collected by Mr. S. M. Dohanian, of the Bureau of Entomology. Paratype localities.—Exeter, N. H.; Pelham, N. H.; Bristol, R. I.

Type.—Gip. Moth Lab. No. 10697AK. Deposited in U. S. Nat. Mus. Type No. 22094 U. S. N. M.

Host.—Evidently a species of *Hypoprepia*.

Described from 24 specimens (13 females; 11 males) bred at the Gipsy Moth Laboratory, Melrose Highlands, Mass.

Cocoons are pure white, thin, clustered together, and usually firmly cemented to the under side of the host caterpillar.

Resembles very closely *A. sarrothripæ* Weed, but the latter has a much less punctate and a highly polished mesoscutum and scutellum; the apical flagellar segments of the female antennæ are much longer than broad and much more slender than in the present species; the hind coxæ are reddish black rather than black; and the abdomen has more or less reddish on the segments posterior to the second, while in the present species the dorsum of the abdomen is entirely black; also, the venter of the abdomen is more testaceous in *sarrothripæ*, and the second abdominal tergite is broader at base so that the lateral margins are less oblique; the venation of the anterior wings also differs, in that the radius and the transverse cubitus meet in a sharp angle in *sarrothripæ*. From the species *phigaliæ*, described above, *compressus* may be distinguished by the much narrower and more compressed abdomen, by the yellowish fore and middle coxæ, by the rougher propodeum, and by the cocoons.

Meteorus triangularis, n. sp.

Female.—Length 5 mm. Head yellowish; eyes black; antennæ yellowish red; stemmaticum black. Prothorax, meso- and metapleuræ yellowish red; mesonotum yellow except the lateral lobes, which are black; scutellum yellow; postscutellum blackish; propodeum black, except the apical angles, which are reddish.

Legs entirely yellowish, except the hind tibiæ, which have a dusky annulus near the base and another at the apex, and the hind tarsi, which are dusky. Wings hyaline, stigma and veins brownish, the stigma without the dark spot found in some species of the genus; the recurrent vein interstitial with the first transverse cubitus; tegulæ and wing-bases yellow.

Abdomen blackish brown above, except the extreme base of the first tergite, which is yellowish, and a yellowish-brown triangular spot at the base of the second tergite, which extends across the entire plate, but is very narrow laterally; the first tergite is longitudinally aciculated on the apical two-thirds or more, which part is black in colour; the deep fossæ, which are found on the upper side of the petiole of a number of species of Meteorus, are wanting in this form. Ovipositor half the length of the abdomen.

Male.—Resembles the female except for sexual differences.

Type locality.—Mass. (?)

Type.—Gip. Moth Lab. No. 6988-1. Deposited in U. S. Nat. Mus. Type No. 22096 U. S. N. M.

Described from eight specimens (4 females; 4 males) reared at the Gipsy Moth Laboratory, Melrose Highlands, Mass. A note in the files at the Gipsy Moth Laboratory, and relating to these specimens, reads, "from a geometrid tray, July 7, 1914."

Cocoons pale brownish, very similar to those of *M. communis* Cress. in colour, density and size.

Rarely the abdominal tergites beyond the first are largely brownish yellow, instead of blackish brown, as in the type specimen.

A NEW COCCID ON THE COCOANUT PALM.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Mr. R. C. McGregor, of the Philippine Bureau of Science, recently visited the Island of Batbatan, from which, so far as I can learn, no insects have previously been obtained. Among the various things he found, the following is perhaps the most interesting.

Furcaspis hæmatochroa, sp. n.

Female scales on leaves of cocoanut palm, scattered. Scale deep rich red, suggesting a drop of blood; circular, slightly convex, with the large, circular exuviæ to one side, often reaching or slightly overlapping the margin, first skin nipple-like, prominent; width of scale about 2.5 mm. Male scales suboval.

Female without circumgenital glands; in form and details of structure closely resembling *F. oceanica* Lindinger, but distinguished by the broad, squarely

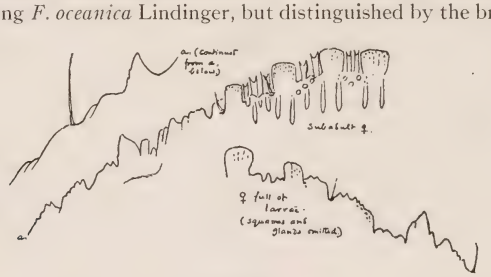


Fig. 20

truncate lobes, the bidentate (not tridentate) squames, and the very prominent pointed elevations on the abdominal margin between the lobes proper and the long, lateral bristle. The details of structure are better indicated by a figure than described. Larvæ in female very large, length about 360 microns. Batbatan Island, Antique Province, Panay, P.I.; June 30, 1918, (*McGregor*). The scale of *F. oceanica* also differs in being suboval instead of circular.

From *F. capensis* (Walker), the new species is known at once by the bifid or bidentate end of the squames and the very broad lobes. It also lacks the series of long hairs found on the cephalothorax of *capensis*. From *F. cladii* (*Aspidiotus cladii* Maskell) it is equally distinguished by the form of the squames, as well as the lateral dentiform process of the abdomen. The lateral dentiform processes are developed in *F. biformis* (Ckll.), which occurs on orchids; but that has a much darker scale and is otherwise different.

A METHOD FOR THE PRESERVATION OF INSECT LARVÆ AND PUPÆ.

BY F. SLATER JACKSON, M.D., MCGILL UNIVERSITY, MONTREAL.

During the summer of 1916 the writer devised a method (as yet unpublished) for the preservation of fresh-water Bryozoa in an expanded condition. At that time, as a matter of experiment, several larvæ and pupæ of *Nymphula maculalis* were placed in the fluid employed for this purpose, with fairly satisfactory results. It was subsequently used for the preservation of insects in all stages. Among these were the larvæ of *Mamestra picta* and other Lepidoptera, and the pupæ and imagines of *Physonota unipuncta*, all of which seem to have retained satisfactorily their form and colour.

Several members of the Montreal branch of the Entomological Society, among others, Mr. A. F. Winn and Mr. Geo. A. Moore, obtained good results with the same fluid. In a letter of February 28th, 1918, Mr. Arthur Gibson, Chief Assistant Entomologist, writes: "I used it rather freely for preserving larvæ of different kinds. . . . I have also spoken of its value to several of our field officers. I hope very much that you will publish your formula soon, as I know many workers will find it of value." These encouraging reports led to further experiment, with the view of obtaining a modification of this fluid which might prove more widely useful as a preservative for material of this character.

It had been found that in many instances, e. g., in the case of large Lepidopterous larvæ, there was frequently marked alteration or loss of colour, and a considerable degree of shrinkage. Pressure of other work, however, and a period of incapacity for concentration of effort, led to the postponement of this matter, until during the past summer opportunity was afforded for further experimentation, which resulted in the provisional adoption of the following method.

The specimens, having been killed in the cyanide bottle, or by means of chloroform vapour, are allowed to relax, straightened if necessary, and placed in a fluid having the following composition:—

Fluid a.

Cane sugar	10 parts
Glacial Acetic acid	5 "
Formalin	2 "
Distilled water to	100 "

The sugar is to be dissolved in the water, and the acetic acid and formalin subsequently added.

In this fluid the specimens are allowed to remain for about 24 hours. They are then transferred directly to *Fluid b.*, which is identical in composition except that the acetic acid is omitted—it being, in fact, simply a 10% solution of sugar in 2% formalin. After about 24 hours this fluid should be changed, and in the case of large specimens a further renewal after the lapse of a week or ten days is advisable, since traces of acetic acid tend, in some instances, to destroy colour.

Attention to the following details may be of assistance in obtaining the best results.

1. In the case of specimens which tend to float, on account either of an oily surface, or through the accumulation of air bubbles (as e. g. in Arctiids, etc.) a preliminary immersion for a few moments in 70% or 90% alcohol will be found to facilitate their contact with and penetration by the fluid.

2. In dealing with large or transparent larvæ, it is well to starve the specimens for a few hours before killing, in order that the alimentary canal may be emptied of its contents. For this suggestion I am indebted to Mr. A. F. Winn.

3. In the case of elongated larvæ, if tubes be employed, they should be almost completely filled with the fluid A., and then allowed to lie horizontally until the transfer to fluid B. is made.

While it is not claimed that the above method is applicable to all forms, or that all colours will be permanently preserved, it has yielded good results in the hands of the writer, and in those of the gentlemen who have so kindly, at his suggestion, given it an extended trial. Larvæ of widely-differing types, such as the following, have been satisfactorily preserved:—various Arctiids and Geometrids, *Euvanessa antiopa*, *Datana* spp., and *Nymphula maculalis*, together with numerous Coleopterous larvæ and the nymphal stages of a number of Hemiptera.

In any event the method is one of easy application, and the ingredients for the preparation of the fluid are cheaply and easily obtainable. No more satisfactory means of preserving insect larvæ and pupæ is known to the writer, by whom this note is submitted in the hope that the method, while admittedly not of universal application, will be found to be of service, and by whom any reports of its successful employment, or suggestions as to its modification, will be gratefully received.

Zoological Laboratory, McGill University, Oct. 29, 1918.

NOTE ON *CHALEPUS NERVOSA* PANZ. AND ITS PROBABLE FOOD PLANT.

The reading of the "Notes on *Chalepus rubra* in New Jersey," published in the December number of the Canadian Entomologist, has prompted me to give a short account of a somewhat similar observation I made last Spring on *Chalepus nervosa* Panzer, the only one of the five recorded Canadian species that I have taken in this Province.

On May 16th, 1918, while doing some outdoor entomological work in that part of Montreal mountain bordering the grounds of the Outremont Golf Club, I noticed that every time the sweeping net was being emptied of its contents, a good supply of this little beetle could be dropped into the killing bottle. The thought struck me of finding out which plant they were being swept off. An active search was then made all around, which soon gave me the desired result The slow, harmless little being was found in colonies of four, eight or more on the leaves of *Solidago latifolia* L., then but a few inches tall. Some of the plants sheltered no less than a dozen specimens. As it was surely mating time, one would have been able to take hundreds of them in an hour. Never before had I met them in such numbers.

They are most easily taken with the hand, provided you do not touch the plant before seizing the insect; a jerk of the stem will bring down the whole

colony to the ground, where they will lie motionless and quite invisible, so that you had better give up looking for the tricky little creature.

No further observations have been made on the habits of the insect, nor have I even seen the larva or the eggs. So we may still doubt if *Solidago latifolia* be really the food-plant of *Chalepus nervosa*. This question might be elucidated next season, and it would also be interesting to find out what sort of damage the beetle causes to the foliage of this handsome wood Goldenrod.

Blatchley, in his work on the Coleoptera of Indiana, says that *Chalepus nervosa* occurs on weeds and bushes of many kinds. So far, I have not seen the beetle crawling in number over any plant except *Solidago latifolia*.

Is it not strange that the discovery was made only after more than twenty years of very active collecting?

Outremont, Que., Jan. 11th, 1919. JOS. OUELLET, C.S.V.

A NEW PARAJULUS FROM BRITISH COLUMBIA.

BY RALPH V. CHAMBERLIN, CAMBRIDGE, MASS.

In a small collection of Chilopods and Diplopods collected by Dr. C. Gordon Hewitt in British Columbia, Sept., 1918, were several specimens of a new species of Parajulus. These were collected at Agassiz. From the same locality were also secured representatives of *Harpaphe haydeniana* (Wood) and *Bothropolys hoples* (Brölemann). A specimen of *Paobius orophilus* Chamberlin, previously known from Kaslo, was taken at Jaspa, Goat Mountain, at an elevation of 7,000 feet.

Parajulus hewitti, sp. nov.

The general colour of the female is brown above with the sides paler, a series of small, black spots along each side caused by the black repugnatorial

Fig. 21.—*Parajulus hewitti*, sp. n. Anterior view of gonopods of male.

glands. The male is darker in colour throughout. The posterior border of metazonites darker down the sides or in the form of an encircling annulus. Anal valves dark. Collum dark along the borders, the remaining portion covered with a dense network of dark lines as is frequent, such also covering the

vertex of the head which is dark excepting the clypeal region. Antennæ brown. Legs yellow.

In the male the second tergite extends much below the level of the collum and is angularly produced below at anterior corner. In the male the second tergite is on the same level below as the collum. The collum is more elongate than in the female, as usual, and the longitudinal stria above the lateral border is strongly marked. On each side of the second tergite below are typically three longitudinal striæ in the male.

The cardo of mandibles of the male is large. It is concavely excavated below, leaving a larger angular anterior process and a smaller posterior one.

Segmental suture in a well-impressed encircling groove, widely curved opposite the pore from which it is well removed.

Cauda of anal tergite straight, caudally rounded, decidedly exceeding the valves in both sexes.

First legs in male strongly crassate and uncate as usual.

The species is most readily to be distinguished by the structure of the gonopods of the male, particularly by the form of the second pair. These are distally branched, presenting two acute spurs, visible in anterior view, projecting from beneath the plate of the first pair, one of them being apical, and a larger mesal principal branch which curves mesad against the corresponding branch of the other gonopod as shown in the accompanying figure.

Number of segments mostly forty-six or forty-seven.

Length near 27 mm.

OVIPOSITION OF *RHINOGASTROPHILUS NASALIS* L.

Referring to Mr. A. E. Cameron's article in *Science* for January 3, 1919, p. 26, I would insist that my observations, as recorded in *Can. Ent.* for July, 1918, are absolutely correct. In repeated instances I saw the fly strike at the muzzle of the horse just as I have described. While the egg of *nasalis* is easily to be distinguished from that of *intestinalis*, I still maintain that both are "practically the same size and shape" as compared with that of *haemorrhoidalis*. I also still believe that my tentative conclusions as to the method of oviposition are extremely probable. As to the observations recorded, they are not inaccurate in any sense.

C. H. T. TOWNSEND.

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POPULAR AND PRACTICAL ENTOMOLOGY.

The Variation of Insects.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Nearly thirty years ago English entomologists began to take a new interest in the variation of Lepidoptera, and in the interval since that time, principally owing to the activities of J. W. Tutt, a very large amount of detailed information has accumulated. Tutt's "British Noctuæ and Their Varieties," in four volumes (1891–1892), deserves to rank as a classic, although at the time of its publication it was received by many with something less than enthusiasm. More recently, the great monograph of the British Lepidoptera, left unfinished owing to Tutt's untimely death, covered the subject of variation in an exhaustive manner, including all phases of the species treated, whether British or foreign. In its exhaustive character, this work runs parallel with Taylor's Monograph of the Land and Fresh-water Mollusca of the British Islands, still in course of publication. The variation of Lepidoptera also receives very full treatment in "The Macrolepidoptera of the World," edited by Dr. Adalbert Seitz, and published in English, French and German. This series of volumes, although planned and published in Germany, is thoroughly international in its character, a large part being written by English entomologists. The volume on the Palæarctic Noctuidæ, for example, is the work of W. Warren. During the war publication has ceased, and I do not know whether it will be continued.

To those who had been concerned primarily with the study of genera and species, all this minute attention to variation seemed rather like counting pebbles on the beach. Let us assume, they said, that all species are variable, and state the facts in general terms. It may be well enough to record varieties, but why give them names? Will not the whole subject be buried in a complex nomenclature? It is, of course, quite true that when one is dealing with a large and little known fauna, the species problem is sufficient to tax one's energies; and, as a rule, the material at hand is not adequate for a study of variation. It is only when the species are fairly well known, and large series of specimens have accumulated, that such methods as those of Tutt become possible or advisable. When, however, the time has come for intensive study, it must be insisted that the records should be exact, and that all looseness of expression should be avoided as far as possible. It is found, in practice, that the only way to avoid ambiguity is to name and define the principal forms, which then become standards for comparison. The literature is full of statements concerning "melanic" or "albinic" or otherwise modified forms, which are so ambiguously referred to that it is impossible to be sure what was intended. Moreover, the adequate taxonomic treatment of the subject gives us a summary of what is known, properly arranged and made intelligible.

While the descriptive side of the study of variation has occupied the attention of many workers, others have taken up the subject for the experimental

side, with results of extraordinary interest, not only to entomologists, but to all biologists. In the earlier days Weismann and Merrifield, in later times such men as Standfuss of Zurich and Morgan of New York, have produced works of such value as to arrest the attention of all naturalists. In particular, Morgan's intensive study of the vinegar-fly, *Drosophila*, has given us a knowledge of the facts of variation and heredity which the most optimistic would have declared impossible a few years ago. Thus all doubt as to the value of minute and detailed investigation of single genera and species has been dispelled, except in the minds of those who take no interest in the biological problems of the day. Indeed, it must be said that any able student who will study a single small group or species from *all points of view*, will be sure to get results of value and importance, whereas as a collector of miscellanea he may go through life without making any significant contribution to science. Thus the new outlook and the new methods open up a great new field for amateurs, who may readily make themselves more familiar than any one else with a special small field of research, knowing at the same time that their discoveries will have some bearing on the whole structure of biological science.

We approach the subject of variation to-day with many advantages not enjoyed by our predecessors. Owing to the rediscovery of Mendel's work, and the great advances in our knowledge of cytology and of the processes of heredity, we are able to interpret what we find with better success. We no longer content ourselves with describing, in objective terms, the phases of variation found, but undertake to classify them according to their true dynamic significance.

Variation may arise from different causes, as follows:

1. Original variation, due to some change in the character of the germ plasm itself. Theoretically, this may come about either through (a) the addition of something, or (b) the subtraction of something, or (c) the redistribution of what was already there, following the phenomena already well known to students of organic chemistry. Tower, of Chicago, appears to have produced variations of this sort in potato-beetles (*Leptinotarsa*), but it is possible to interpret them as the result of selective destruction of elements (genes) in the germ plasm, which is, at least theoretically, a different matter from altering the genes (factors determining characters) themselves. The sudden appearance of red on the rays of a sunflower in Colorado can be interpreted as due to a doubling-up or duplication of a gene for red which is undoubtedly present in the normal wild plant.

   Furthermore, when a variation occurs in a gamete (unfertilized germ cell) which is recessive to the normal,—that is, fails to produce any effect when united with a normal gamete,—it may be an indefinite time, possibly a thousand years, before there will be any visible result. A visible result will only appear when two individuals, each carrying the modified character, chance to mate. Thus when we witness what appears to be an entirely new "break," we may be observing the consequences of a chemical change which occurred long ago, the causes of which, whatever they were, have long ceased to operate.

   The most important evidence has been obtained by Professor Morgan and his associates in their studies of *Drosophila*. In numerous cases new variations have arisen under circumstances which seem to

indicate without question the mutation of factors or elements in the germ-plasma.

2. Variation due to new combinations, or to recombinations of genes normally carried by a species (as in sex-dimorphism, polymorphism, etc.). This is the kind of variation we are most familiar with, and which has been the subject of so much experimental research. Not only may genes or determiners be shuffled in inheritance, as Mendel described, but those constantly present may be greatly modified by the unexpected appearance of others, which have until then escaped notice. Thus in the sunflower there is a series of pattern-factors, which only become evident when the factor for red rays enters the combination.

   In the case of the many mutants of *Drosophila* observed by Morgan, all within the limits of a single species, it is difficult to resist the conclusion that a process of subtraction is going on under our eyes, leaving combinations which are new in the sense of lacking some of the original elements. In other analogous cases, we are struck by the fact that the *same kinds* of subtractions occur in many different genera and species, showing that the tendency to perform these tricks is deep-seated in the protoplasm of the whole race. There is here involved a question which cannot be said to be settled, and to which much additional research must be directed.

3. Variation due to the direct action of the environment, which, as we have learned from Weismann, is not inherited. Nevertheless, the power to react to the environment in particular ways *is* inherited, and hence even these variations cannot be dissociated from the question of heredity.

On the negative side, as it were, we have the facts of palæontology. The study of fossil insects shows us that many apparently trivial characters, such as the arrangements of spots on wings, are of enormous antiquity. Not only this, but as Wheeler's researches on the ants of Baltic amber have shown, specialized habits and reactions are likewise millions of years old. It, therefore, becomes more probable that the phenomena of variation which we witness to-day represent, mainly at least, the shuffling of very ancient cards.

In the Canadian fauna, there are several notably attractive opportunities for the study of variation. I will refer now only to a single family of insects, with which I have been especially concerned in recent years: the Saturniidæ. The publication of Packard's Monograph (Memoirs National Academy of Sciences, vol. XII) brings the subject fairly up to date, and makes it convenient to go forward from the point there attained. The genus *Samia*, as represented in Canada, is extremely interesting. There is not only the question of the relationships of the species *cecropia*, *gloveri*, *columbia* and *rubra*, but *columbia* has in the west a remarkable race *nokomis* (Brodie), while *rubra* produces at Kaslo a form *kasloensis* Ckll. These are merely conspicuous outstanding facts; large collections from many localities, together with experimental breeding, will bring out innumerable details of interest. Another very interesting species is *Telea polyphemus*, the variations of which should be studied exhaustively, and compared with those of the great Asiatic silk-moths. The Hemileucidæ, also included in Packard's book, afford similar opportunities, and owing to their smaller size are somewhat more manageable.

NOTES ON THE CANADIAN REPRESENTATIVES OF BRITISH SPECIES OF BEES.

BY F. W. L. SLADEN, APIARIST, DOMINION EXPERIMENTAL FARMS.

Of the twenty-eight genera of bees given in Saunders' "Hymenoptera Aculeata of the British Isles," no less than twenty-two occur in Canada. The six absent are small genera belonging to an ill-defined unimportant complex in the *Andrena* group, several of which may yet be found to exist in Canada when this large genus, full of raw material, has been analyzed. In most of the genera common to both countries, there are many Canadian species which are more or less closely related to British species. The following are a few outstanding examples:

Colletes cunicularia Linn.

Colletes inæqualis Say, by far the largest species of *Colletes* in Eastern Canada and the only one occurring in spring, is apparently the representative of *C. cunicularia* Linn., also much the largest species and the only spring one found in England. Both are among the earliest bees to appear in spring. Ottawa specimens differ from British in having a much shorter coat, which is generally paler and greyer (less brown), and they have well-developed bands of white felt* on the margin of each segment of the abdomen. These bands in British specimens are scarcely discernible, being composed of fewer, looser hairs, which are dingy. Ottawa specimens are smaller; several females measured averaged in length 13.33 mm.; British females 14.00 mm.; Ottawa males 11.00 mm.; British males 13.25 mm.

Andrena clarkella Kirby.

Comparison of a male and two females of *Andrena bicolor* Prov. taken by the writer at Ottawa, and a female from Abitibi, with two males and two females of *A. clarkella* Kirby, taken at Maidstone, Kent, England, and with Saunders' description of this species shows no differences either in structure or colour. Even the tint and extent of the different hair colours in both sexes are identical. The characteristic red and red-haired hind tibiæ and tarsi, and black-haired notum in the female, and the comparative lengths of the antennal joints 3, 4 and 5 in both sexes are the same. The Canadian examples however, are a little smaller:—females, average length 12.00 mm.; Maidstone females 12.75 mm.; Ottawa males 8.75 mm.; Maidstone males 9.75 mm.; and the coat on the thorax and abdomen is much shorter and less shaggy in the Canadian specimens. In both countries these are early spring bees. The Ottawa females were taken during early willow-bloom on April 25, 1915, about ten days after the snow had gone, and the male on April 27. In England it is taken in early March and has been recorded as early as February 19. It is also widely distributed northwards and uncommon, both in Canada and England.

Andrena wilkella Kirby.

Andrena winkleyi Vier. is the same as *A. wilkella* Kirby. I can find no differences in structure or size. Both are abundant in late spring at Ottawa and Dover respectively, and are fond of the same plants; *Myosotis*, etc. In both, the third antennal joint is shorter than the fourth, a character by which *wilkella*

*The word "felt" is used to describe very short, close hair, the individual hairs of which are thicker than ordinary hairs. Felt grades into ordinary hairs.

is known from its close ally *similis* Sm. This is a short-haired species in which white felt bands on the abdominal segments are well developed with a corresponding bare area on the disc of the segment.

Osmia fulviventris L.

Specimens of both sexes of *Osmia purpurea* Cr. from Ottawa and Toronto agree in every respect, including size, with those of *O. fulviventris* L. from Dover. This is, therefore, a parallel case to that of *Andrena wilkella*, and it is perhaps worthy of note that the *Osmia* appears in late spring after most of the other species of its genus have appeared as in the case of *A. wilkella*.

Megachile ligniseca L.

Comparison of both sexes of *Megachile inermis* Prov. (*M. decipiens* Lovell and Cockerell) taken at Ottawa, shows this species to be closely related to *M. ligniseca* L. of Europe. Prominent characters possessed in common by specimens from Dover and from different parts of Canada are the very short, decumbent black hair on the disc of the sixth segment of the abdomen and the large head in the female. But the white felt bands on the margins of the segments of the abdomen, well marked in Canadian specimens are rudimentary in the British specimens. Canadian specimens also differ in having the pollen collecting-brush cream coloured—not reddish, and the body hairs grey and black—not brown, and the coat distinctly shorter. Ottawa specimens are also smaller, average length of Ottawa females 14.33 mm.; Dover females 16.00 mm.; Ottawa males 12.61 mm.; Dover males 13.88 mm. Specimens have been bred in this country from a rotting piece of an apple tree found by Prof. Arthur Wiley at McGill College. In England it burrows in wood that is more or less decayed. Most of the other *Megachile* burrow in the ground.

The same differences,—shorter coat, which is whiter (less brown) with stronger white felt bands, and paler (less red) pollen brush, separate *M. vidua* Sm., a species common all over Canada from *M. willughbiella* Kirby, a species common in England and Northern Europe.

Anthophora furcata Pz.

This British bee is represented in the American fauna by a bee known by the name of *Clisodon terminalis* Cr., which occurs in Canada from coast to coast and at least as far north as Cochrane, Ont. and Edmonton, Alta. Friese gives the range of *A. furcata* in Eurasia from Norway to Mongolia and south to Caucasia. Ontario specimens differ from British in both sexes in having a shorter coat—much shorter and scantier on the abdomen of the female and generally less brown but greyer and paler, and the hairs on the abdomen run into dense pale bands on the margins of the segments, taking, in the female the extreme form of narrow bands of white felt, interrupted in the middle. No tendency to white felt bands is noticeable in the specimens from Dover. Saunders even gives this as a character for the species. The white felt bands are also absent in four females from the Pacific Coast, (Agassiz, B. C., Shawnigan Lake, V. I., and Victoria, V. I.) but they may have been rubbed off.

Specimens from Ottawa are distinctly smaller than specimens from Dover, but the females from the Pacific Coast are even larger than British females as shown in the following table, and they probably represent a distinct species or at least a geographical variety to which the name *neofurcata* is here given.

7 Ottawa males average length 9.50 mm.
7 Ottawa females average length 10.75 mm.
5 Dover males average length 10.70 mm.
5 Dover females average length 12.80 mm.
4 Pacific Coast females average length 14 mm.

In England, *Anthophora furcata* is very faithful to its food plant, *Stachys sylvatica*, and the Canadian forms may always be found on *Stachys palustris*. Saunders notes that it burrows in "dead wood," although other species of the genus burrows in the ground. Attracted by a heap of white sawdust around a decayed but still hard stump near Hull, P. Q., on August 16th, 1913, I found this to be riddled with the burrows of *Clisodon terminalis*. The exceedingly active females, resembling honey-bees in appearance and size, passed in and out of numerous holes in the stump as frequently as the workers of a strong colony of bumble-bees.

Bombus and **Psithyrus.**

These northern genera, so rich in biological material, furnish an interesting contribution to this study. They never develop felt bands but there is a uniform coat of long hair resembling fur.

Bombus borealis Kirby.*

Bombus borealis Kirby, fairly common and widely distributed in the boreal region of Canada east of the Rocky Mountains has its British representative in *B. distinguendus* Morawitz, the distribution of which, according to Hoffer, extends to Siberia. Here again the pattern and even the tint of the coat, deep greenish yellow with a black band across the thorax, very variable in most species of *Bombus*, is common to both forms with the unimportant exception of more or less black hair on the last segment of *borealis*, but the British specimens are larger (average length of females 20 mm. compared to 18 mm. in *borealis*) and they have a much longer and more uneven coat.

In the Mountains and Pacific Coast region, *borealis* is replaced by a form, *appositus*, that is intermediate in size between British *distinguendus* and *borealis*, having a coat slightly longer than *borealis* and the yellow band on the anterior part of the thorax very pale while there are no black hairs on the abdomen. *Appositus* is evidently still more closely related to *distinguendus* than is *borealis*. In both the Old and New Worlds, the queens of all these forms appear later in the spring than those of almost every other species of *Bombus*. The colonies consist of comparatively few workers, and the young queens and drones are raised early. The period of activity therefore lasts a shorter time than in the case of the other species.

Bombus terrestris L.

One of the commonest and most aggressive species of *Bombus* in England and the continent of Europe is *terrestris L.* This is represented in Canada from the Atlantic Coast to the Mountains by an equally common and aggressive species, *B. terricola*. In habits, *terricola* agrees with *terrestris* not only in those common to the *terrestris* group such as biting holes at the bases of flowers, but also in the unique habit that separates *terrestris* from its close ally in England, *lucorum*, of continuing to leave its winter quarters in small numbers from the opening of spring right on until about mid-July when all other species have

*This name has priority over *distinguendus*.

ceased to appear, instead of during the shorter and more definite period common to all the other species of *Bombus*. *Terricola* has the tip of the abdomen tawny like many *terrestris* forms. In *lucorum* forms, however, this remains always white. *Terricola*, however, has a much wider yellow band on the abdomen than any Old World form of *terrestris*. In this respect it converges towards other species of *Bombus* found within its region, *fervidus*, *borealis*, etc., *Terricola* has the coat much shorter than *terrestris*. It is also smaller, average length of female *terricola* 18 mm., female *terrestris*, from Dover, 20 mm.

B. terricola is replaced in the Mountains and on the Pacific coast by the closely related *occidentalis*, a somewhat longer-coated species. I do not think that *terricola* and *occidentalis* intergrade because I have taken both forms at Banff, Alta.

Bombus lucorum L.

Bombus lucorum, above mentioned, is, in Britain and Europe, a small mountain or northern form with a rather long coat. *B. moderatus* Cr. a species of the *terrestris* group with colour pattern the same as that of *lucorum*, is found at Banff, Alta. and in Northern B. C., Yukon Territory, and Alaska. It undoubtedly is a *lucorum* form. It differs from *lucorum* only in the somewhat paler tint of its yellow bands. In this respect, it not only follows *appositus* of the same region, but approaches *albocinctus* Sm. the *lucorum* form found in Kamchatka, Siberia, which has these bands white.

Bombus lapponicus Fab.

Franklin notes the close relation between *Bombus melanopygus* Nyl., a very long-haired, red-banded species, common in the Mountains and Pacific Coast region and *Bombus lapponicus* Zett. a species found on the high moors of the north of England and Scotland and in arctic and sub-arctic Europe. *Sylvicola* Kirby, from Arctic Canada, of which *melanopygus* is probably a variety, seems identical with *lapponicus*.

Psithyrus vestalis *Fourc.*

Bombus terrestris is preyed upon in England by *Psithyrus vestalis* Fourc. A *vestalis* form known as *ashtoni* Cr. is found throughout the range of *B. terricola* and is probably parasitic on it. *Ashtoni* is smaller than *vestalis* and has a shorter and paler coat.

Apis mellifera L.

The variety of honey-bee native to Britain has an entirely black tegument, dark brown hair and feebly-developed white felt bands on the margins of the segments. This variety is native to the whole of Western Europe, and it has been introduced into and has spread through Canada during the last two or three hundred years. It still predominates in the Gulf Region, in the north, and on the Pacific Coast. But in Southern Ontario and on the Prairie, it has been largely replaced by the Italian bee, introduced about fifty years ago from Southern Europe, which has the tegument of the abdomen banded with orange, has paler hair and well-developed white felt bands. This bee is also slightly smaller than the black bee. The honey-bees of the Prairie show great constancy in the strong development of the white felt bands.

CONCLUSIONS.

1. The bee fauna of the boreal zone of America contains a number of species closely related to, and in some cases indistinguishable from those in

north-western Europe and furnishes evidence of a former land connection with a climate comparable to that of Britain or Ontario, in which these species lived.

2. There are, however, in a number of cases certain more or less pronounced differences in character between the descendants now living in Britain and Canada. As a rule, the Canadian forms are smaller, and they have a shorter, closer, less shaggy coat, the colour of which is not so rich or deep, but paler, more dingy; brown changes to ashy grey or dingy white, and red to orange or cream. Usually in the genera where white felt bands are liable to occur on the abdominal segments, these bands either appear for the first time in Canadian forms, or are better developed, that is to say, are wider and more extensive as well as of a more extreme type, with a corresponding reduction of hair on the disc of the segment. Melanism is less frequent and less pronounced. These differences are so widely spread that they evidently represent a definite principle.

3. Searching for the cause of these differences we find there is an approach towards the British type of characters on the Pacific Coast and in the north of Canada where the summer climate is cool as in Britain, and they are most departed from in the interior and southern part where it is warm. A good illustration of this, in addition to those already given, is found in *Megachile perihirta*, Ckll. a species that has no Old World representative. At Lethbridge and in the Kootenays, this species has definite white felt bands on the margins of the abdominal segments and there are no black hairs amongst the pale ones on the apical segment. At Victoria, B. C., the white felt bands are weaker and partly broken, the hairs composing them being longer and less dense, and the whole coat is slightly longer. At Cochrane in Northern Ontario these bands are still weaker and the hair on the apical segment is black.

All the species of *Bombus* occurring on the Pacific Coast, in the mountains of B. C. and in the Arctic, have a longer, shaggier coat than those occurring in Ontario. The species of *Bombus* that has the most southerly range in Canada, *B. pennsylvanicus* has the shortest coat of all. Species of *Bombus* in the Shetland Islands are rather larger and have longer, shaggier coats than the same species in Scotland. In Great Britain and in Canada also, not only are the species having longer and shaggier coats more plentiful in the north and west, but the shorter-coated species, if they extend so far, grow longer coats.

For the same or closely related species, size tends to become as a rule, smaller in the south and interior, but the south-interior contains many species, not found all over, some of which are of giant size.

In Canada, the interior and southern conditions reach their extreme at Medicine Hat, a dry, hot, basin-shaped locality in Southern Alberta. Here the species of *Anthophora* belonging to the subgenus *Amegilla*, characterized by an extreme development of the white felt bands and swift flight, are common. Species of *Amegilla* are numerous in Turkistan, Central Asia. At Medicine Hat species of *Halictus*, *Colletes*, *Melissodes* and *Melecta* appear that are almost covered with dust-like felt. Amongst the parasitic bees, *Coelioxys ribis* Ckll. is common throughout Canada. In Southern Alberta is found a small form of this species known as *grindeliæ* Ckll. (average length of female 10.33 mm. compared with 11.66 mm. of *ribis*). In *grindeliæ* not only are the white felt bands on the abdomen much wider, but the face is largely covered with white felt, and the white hair on the sides of the thorax inclines towards felt. At

Medicine Hat, too, a general change in tegmental colour, which must not be confounded with hair colour, is noticeable. Yellow bands and markings in the bare or nearly bare bees and wasps expand and multiply at the expense of black, and species, often of giant size, having red markings, especially on the first segment of the abdomen begin to appear, notably in the bee genera *Anthidium*, *Epeolus* and *Nomada*, and in the wasp genera, *Vespa*, *Bembix*, *Microbembex*, (yellow); *Philanthus*, *Cerceris* and *Odynerus* (red markings). Several species of *Andrena* from Toronto and Winnipeg regions have a red abdomen, but on the coasts and in the North the abdomen is always black. At Oxford, England, *Andrena hattorfiana* has a red abdomen, but at Dover the abdomen of this species is black.

Reduction of humidity acts in the same way as heat, but it appears to be less important. Indeed, in the present study, it can be demonstrated to be a negligible factor if rainfall be taken as its criterion. The summer rainfall of Dover and Victoria, B. C., is much less than that of Ottawa and Toronto. But humidity cannot be judged by rainfall which increases the relative humidity of soil and air in our region much less than heat reduces it.

Differences in winter temperature and rainfall, however, do not affect the characters to any extent. The same varieties are found on the mild and wet Pacific Coast as on the dry cold mountains. This is the more remarkable when when we remember that the distribution of the plants on which the bees feed is greatly affected by winter climate.

The same differences that are found between bees in a cool coastal summer climate and a warm interior one, are found between spring and summer flying bees in the same climate, and they are more marked in regions like Britain and the Pacific Coast where the spring is cool, than the interior of Canada where it warms up quickly. In England, and to a less extent in Ontario, the one species of *Colletes* that flies in the spring is larger and has a longer coat with feebler felt bands than the many species that fly in summer. Similarly, the early spring flying species of *Andrena* are large, have long coats and no felt bands; the summer flying species are generally smaller (except giant southern forms), have shorter coats with bare areas and frequently felt bands. At Ottawa, *A. cockerelli* which appears in spring before the snow has gone, has a longer, shaggier coat with less tendency to bare areas than any other species in Eastern Canada. Britain and the Pacific Coast have several large, robust, shaggy and long haired species of *Anthophora* appearing in early spring as well as shorter haired summer species, but the long haired spring species are not found on the prairie or in Eastern Canada.

Many of the differences noted are more shown in the females than in the males. Abdominal felt bands are always better developed in the females than in the males. Females of numerous species develop red tegumental markings, while the males remain black or yellow. In many species of *Sphecodes* the abdomen is black in the male and red in the female. In a large wasp found in Medicine Hat, Alta., *Eucerceris gloriosa*, the male is yellow and the female red. In *Vespa carolina*, a species found at Point Pelee, Ont., by Mr. Taverner, the queen has orange markings, while in the workers these markings are yellow. Can the reason be that the female has a longer adult existence, or that the continuance of the species depends solely upon it after the male has died?

Do the cool and warm conditions during the flying season work their opposing effects on the adult or the larva, or both? The female *Halicti* pass the winter as adults, but live on until summer when they raise their brood. They have short coats and are of small size. The honey-bee raises its brood and passes the night in activity under the conditions of all seasons in an artificial heat provided by the colony. The European species of *Andrena*, *A. gwynana* Kirb. has two broods in the season. The spring-flying adults raised the previous summer hibernate as adults and are more robust with longer coats than the summer flying adults which are raised in the spring and have the slender, feeble appearance of the few species of *Andrena* found in the tropics.

Queens of the Italian bee that have been chilled in the pupa stage have the orange part of the integument darkened, and queens of *Bombus lapidarius* L. that slowly passed the pupa stage in the lowest temperature that could support life, had their black and red coat changed to brown.

How far the fact that British forms have a larger number of close allies on the Pacific Coast than in Eastern Canada is due to migration via Asia and how far to the action of similarity of climate cannot be estimated until our knowledge of Siberian forms, at present meagre, is greatly increased. The hairs clothing the body are of value to the bees for gathering pollen for which they are admirably adapted, being branched but unbranched in wasps. Their value for keeping the insect warm in chilly weather is apparently of secondary importance because wasps are almost as scantily clad in the north as in the south, and the parasitic bees are scantily clad. Bright colours and striking patterns, whether of coat or tegument, for instance in *Bombus* and many parasitic bees and many wasp genera, are usually of the warning kind and therefore are liable to regional convergence. In England, most of the species of *Bombus* have a white or a red tail. In Canada the only white or red-tailed species are in the western mountains and the north.

CATOCALA ULALUME, A CORRECTION.

BY G. H. FRENCH, CARBONDALE, ILLINOIS.

It may be unfortunate that Mr. Herman Strecker did not figure all of the new species that he described, for his descriptions, like those of some of the rest of us, were not always clearly drawn. Another unfortunate thing, for me, is that during a few years in which I was compelled to drop entomological work some of my material was lost, among which was *C. ulalume*. The specimens upon which were based my note in the Canadian Entomologist of January, 1919, page 16, were Dr. Holland's *C. carolina*, and that is really a variety of *C. flebilis*. This species is too small for *C. ulalume*.

Since writing the above-mentioned note I have seen material from several localities outside of Southern Illinois, containing a number of forms of *C. lacrymosa* and *C. dejecta*. One of these, I think from Kentucky, has the bluish sheen of *C. dejecta*, with no noticeable brown except a narrow subterminal shade of very dark brown, not noticeable except under the lens. This specimen had t. p. dentation of *C. lacrymosa*, but lacks the white along the t. a. and t. p. lines near the posterior margin of the wing that is so prominent in *C. lacrymosa*. The whole wing is pretty evenly dusted with black atoms.

ON THE MALE AND IMMATURE STATE OF *GRYLLOBLATTA CAMPODEIFORMIS* WALKER.

BY E. M. WALKER, TORONTO.

The remarkable Orthopteroid insect described by the writer as *Grylloblatta campodeiformis*[1] has been hitherto known only from the type and paratype specimens, both of which are mature females. Through the kindness of Dr. C. Gordon Hewitt, Dominion Entomologist, who visited Banff, Alberta, the type locality, in 1916, I have had the privilege of examining seven additional specimens, including a mature male, two mature females and four nymphs, of which three are males and one is a female.

One of the adult females was taken by Dr. Hewitt, in company with Mr. N. B. Sanson, Curator of the Rocky Mountains Park Museum, and is well preserved in alcohol. The other specimens were dried and were found in the collection of the Rocky Mountains Park Museum, with the exception of one male nymph, also dried, from the National Collection. All were taken in the vicinity of Banff, the labels giving the following data:—

"Sulphur Mt., Lab. No. 50, July 18, 1916." (Adult female).

"Sulphur Mt., Oct., 1908, N. B. Sanson." (Adult female).

"Sulphur Mt., Nov. 21, 1910, N. B. Sanson." (Adult male).

"Sulphur Mt., Nov. 21, 1910, N. B. Sanson." (Male nymph, stage A).

"Sulphur Mt., top of trail, on snow, Jan. 24, 1910, N. B. Sanson." (Male nymph, stage B).

"Banff, Nov. 5, 1906, N. B. Sanson." (Male nymph, stage B.)

"Sulphur Mt., trail, Nov. 9, 1915, N. B. Sanson." (Female nymph).

Since the original description of this insect was published several papers by Professor G. C. Crampton have appeared, in which its structure and affinities have been discussed at some length. He has dealt chiefly with the thoracic and cervical sclerites,[2] the antennæ[3] and to some extent with the female genitalia.[4] The latter have been fully investigated by the present writer, and will be described in a paper on the terminal abdominal structures of Orthopteroid insects, which it is expected will appear in the near future.

The present paper will be chiefly confined to a description of the adult male and the immature stages of both sexes, as represented by the material at hand, a full discussion of the phylogenetic relations of *Grylloblatta* being reserved for the future paper just mentioned.

It will be convenient to describe the adult male first, then the immature stages of the male and female, respectively.

The Adult Male.

The adult male measures 16.5 mm. in length, and is similar to the female in every respect, except the terminal abdominal segments and genitalia.

The 8th segment shows no special features, being similar to the 7th and other typical abdominal segments. The 9th segment, on the other hand, is very remarkable. It is of considerable size, larger than that of the female, and about equal in width to the 8th segment. The tergite (Pl. VIII, Fig. 1) is about twice as broad as long, with a slightly and somewhat irregularly arcuate hind

1. Walker, E. M., Can. Ent., 1914, vol. XLVI, pp. 93–99.
2. Crampton, G. C., Ent. News, 1915, vol. 26, pp. 337–350.
3. Crampton, G. C., Can. Ent., 1917, vol. 49, pp. 213–217.
4. Crampton, G. C., Journ. N. Y. Ent. Soc., 1917, vol. 25, pp. 25–237.

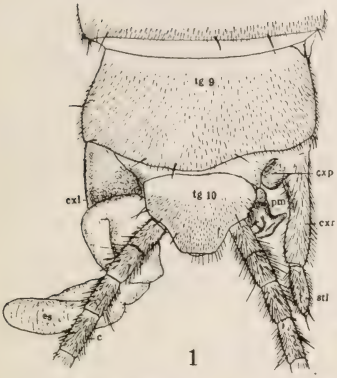
margin, and is nearly if not quite, symmetrical. It is separated from the sternal region only by a suture, there being no distinct pleural membrane (Figs. 8 and 9). The sternal region (Fig. 2) is unique among Orthopteroid insects in being divided into three sclerites, a basal plate, the true "sternite," and two disto-lateral "coxites," which are connected with the sternite by distinct articulations. The sternite is of nearly the same size and form as the tergite, although with a somewhat more decidedly arcuate hind margin and is slightly asymmetrical, being longer on the right side than on the left. The coxites are remarkably asymmetrical and different in form. Both are roughly triangular and bear well-developed styli at their apices. The left coxite (cxl) is a large scoop-shaped plate, whose base extends from the left pleural suture to a point well to the right of the median line. The right coxite (cxr) is of about the same length, but much less than half as broad at base, and is confined to the right side. Its upper margin bears a prominent chitinous process (cxp) directed ento-caudad. Both coxites and styli are thinly pubescent, like the general body-surface, and the styli also bear a few short bristles, chiefly toward the apices.

The 10th segment, as in the female, is much smaller than the 9th, but is fairly prominent. The tergite as viewed from above is symmetrical and trapezoidal in form, being narrowed distally to a truncated apex. Viewed from behind, however, its lateral lobes are seen to be produced mediad beneath the cerci and paraprocts (*laminæ subanales*) into a pair of free, unequally developed arms. The left arm is the longer and is entirely chitinized, except at the tip, which is slightly expanded into a little rounded pad. The right arm is shorter than the left, chitinized only at the base and lacks the pad; having the appearance of an aborted structure. At the base of the cerci, which are similar to those of the female, there is a small ventral basipodite. The supra-anal plate (sa) or "epiproct" is vestigial and feebly chitinized. The paraprocts, which are situated on each side of the anus, are also poorly developed and unchitinized, though pubescent. There is no 10th sternite.

The Genitalia.

The phallus is bulky and irregular, resembling in general appearance that of certain Blattidæ, and also recalling that of the Phasmidæ. It consists of two large lobes separated by an oblique fissure, extending from about the mid-ventral line to the left side at the base of the 10th tergite (Figs. 3 and 4). As seen in Fig. 2 both lobes project well behind the posterior margin of the 9th sternite, the right lobe terminating in the space between the two coxites, while the left lies chiefly in the concavity of the left coxite. The right lobe bears upon its dorso-caudal surface a heavily chitinized prominence (pm), divided into two irregularly folded parts, bearing several blunt, tooth-like processes. Just above it are two nearly horizontal plates (lm), whose freely projecting outer (right) extremities are bent backwards towards the chitinous prominence just described. These parts, together with the right coxa, with which they are associated, appear to form the clasping apparatus, in which the left arm of the 10th tergite may perhaps be included. The exposed part of the right lobe is chitinized and pubescent.

The left lobe is entirely membranous except a small, ventral patch, which is chitinized and pubescent. It is remarkable in being produced into a long, coiled membranous tube, which apparently has no opening but is an evaginated



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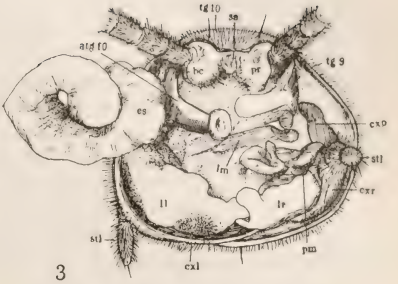

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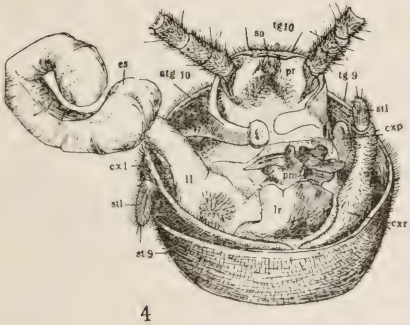

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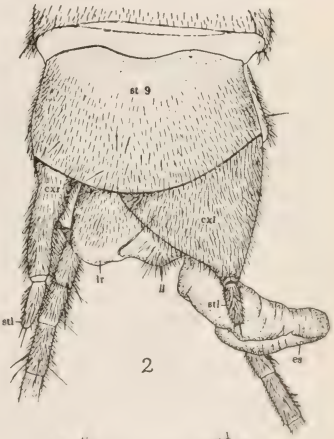

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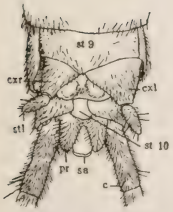

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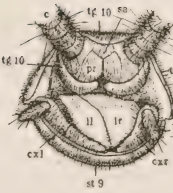

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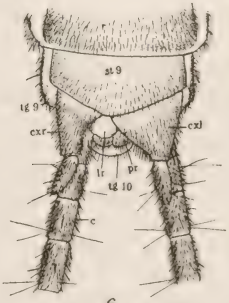

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GRYLLOBLATTA CAMPODEIFORMIS WALK.; STRUCTURAL DETAILS. (P. 138.)

sac, comparable to the sheath of the eversible hook, which is present in the same situation in many Blattidæ, sometimes on the right side, sometimes on the left. There is, however, no hook in *Grylloblatta* on the left side, although the toothed prominence on the right side is apparently its homologue. The purpose of the coiled sac is not evident. It seems to be too far from the opening of the ejaculatory duct to serve as an eversible seminal reservoir or a bursa copulatrix, for although I was unable to detect the genital aperture it is extremely probable that it lies in the fissure between the two lobes.

The disto-medial angle of the left lobe is produced into a rounded process, which fits into a fold of the right lobe. Its inner surface is somewhat grooved and lies in the fissure, possibly functioning as a seminal channel. It much resembles the "penis" of Periplaneta, Blaberus and other Blattidæ.

Probable Copulatory Position.

In the absence of any actual knowledge of the copulatory position in *Grylloblatta* it is perhaps of little value to speculate as to its nature, but the following suggestion may be of some use as a guide to future observations.

It is probable that the copulatory position is radically different from that of the Blattidæ and Mantidæ, in which, on account of the shortness of the ovipositor, an end-to-end connection is possible. I have a female specimen of *Stagmomantis carolina* with a portion of the male body attached, and it shows that the decurved dorso-caudal margin of the ovipositor is received within the genital cavity of the male, the body of the latter being twisted so that its dorso-ventral axis is perpendicular to that of the female. Such a position would be impossible in an insect with so long an ovipositor as Grylloblatta, and it is, therefore, extremely probable that the copulatory position is more nearly comparable to that which is usual in the Orthoptera and Phasmoidea, i. e., the genitalia of the male are applied to the vulva of the female, the two sexes facing the same direction. This is the more probable in that the genital aperture of the female *Grylloblatta* opens directly on the ventral surface at the base of the ovipositor, not being covered by a subgenital plate.

The scoop-shaped left coxite seems adapted to receive the base of the ovipositor, covering the vulva. This would place the right coxa on the right side in such a position as to receive the lower edge of the right dorsal valve of the ovipositor in the notch between its distal part and the chitinous spur (exp) on its upper edge, which, from its direction would be on its inner side (Fig. 15). The inner edge of the right ventral valve would then be received between the right coxite and the toothed process of the right lobe of the phallus, or possibly between the latter and the transverse laminæ (1m). This position would also bring the oblique fissure more directly in line with the longitudinal axis of the body of the female, and thus permit a more direct passage for the spermatic fluid or spermatophore into the vagina.

The Male Nymph.

The earlier of the two stages represented (stage A) measures 11 mm. in length, the hind tibiæ 2.75 mm. The antennæ, one of which is incomplete, have 22 segments. It is quite similar to the adult in form, except in the somewhat less tapering antennæ, and slightly stouter femora, particularly the profemora, which are nearly half as broad as long, and the terminal abdominal segments and genitalia.

The 9th segment (Fig. 5) is relatively much smaller than in the adult. Its sternal region is clearly divided into sternite and stylus-bearing coxites. The asymmetry is noticeable but far less marked than in the adult, the base of the left coxite being only about 1.5 times as broad as that of the right. Both are ventral in position and triangular in form, with relatively large styli. There is as yet no indication of the spur borne by the right coxite in the adult.

The 10th segment is relatively larger than in the adult and consists chiefly of the tergite, which forms a ring broken only by a small sternal area (st 10). The latter is quite distinct but membranous. There is as yet no distinct appearance of asymmetry in the 10th segment.

In the intersternal membrane between segs. 9 and 10 two slight ventro-lateral raised areas are visible, the rudiments of the two lobes of the phallus (Fig. 10).

The cerci are quite similar to those of the adult except that they are relatively stouter, and the constriction between the first two joints is less clearly defined.

The supra-anal plate and the paraprocts are much more prominent than in the adult, the former being slightly chitinized above, the latter membranous but pubescent.

The two specimens belonging to the older nymphal stage (stage B) measure 11 mm. and 12.5 mm., respectively, the abdomen of the former being contracted. The hind tibiæ in each are about 3.1 mm. long, and measurements of other parts are also closely comparable. The form of the 9th sternum has changed very little from stage A, though the asymmetry of the coxites is a trifle more marked. The principal change is the greater contrast in size between segments 9 and 10. The former is relatively considerably larger, the latter smaller and almost entirely concealed in a direct ventral view (Fig. 6). The ventral edges of the 10th tergite nearly meet one another, there being no longer a distinct 10th sternum. The supra-anal plate and paraprocts are also greatly reduced, almost as much so as in the adult.

Owing to the increased depth of segment 9, the intersegmental membrane on which the phallus develops is now nearly vertical instead of horizontal in position. The two lobes of the phallus (Fig. 7) are much larger, asymmetrical and separated by a fissure having a obliquity similar to that of the adult but less marked. No chitinized areas are as yet present.

The difference in size between these two nymphal stages is so slight that it is almost certain that they represent successive instars.

The Female Nymph.

The single immature female is somewhat larger than any of the male nymphs, measuring 15 mm. in length, the hind tibiæ 3.25 mm. The antennæ have 24 to 25 segments. The 8th abdominal sternum is similar to that of the adult, except that it lacks the pale median area present in the latter, and is less firmly chitinized. The ventral valves of the ovipositor or valvulæ (anterior gonapophyses) arise from the hind margin of the 8th sternum and extend back a little beyond the hind margin of seg. 10. They are straight, subcylindrical, broadest at base, and taper to bluntly pointed apices. The basal segments (basivalvulæ) are well marked off by a distinct constriction. The sternal region of seg. 9 is clearly defined and still has its primitive horizontal position, in line with that of seg. 10; whereas in the adult it becomes vertical, so that the bases of the dorsal and inner valvulæ are directly above those of the ventral valvulæ (not including the basivalvulæ).

The dorsal and inner valvulæ (outer and posterior gonapophyses) arise in the same transverse plane across the middle of the sternum. The former are subcylindrical and terminate in well-developed styli like those of the male, which reach just beyond the tips of the paraprocts, and are about half as long as the valvula itself. The apices of the ventral valvulæ reach to about the ends of the dorsal valvulæ, without the styli, and as the dorsal valves in the adult are distinctly longer than the ventral valves, it is evident that the styli are not cast off at ecdysis, but go to form the apices of the dorsal valves.

The inner valvulæ occupy the space between the outer or dorsal pair, and are contiguous with the latter and with each other at base. They are simple, styliform processes, falling a little short of the dorsal valvulæ without the styli.

A comparison between the structure of the immature and mature ovipositor of *Grylloblatta*, and the remaining parts of the 9th sternum will be made in my later paper. It may be mentioned here, however, that the lateral parts of the 9th segment, shown in Fig. 10 (vf) become the small triangular plates which Crampton has termed the "valvifers."

Concluding Remarks.

It is not my intention to discuss here in detail the phylogenetic relations of *Grylloblatta*, but attention may be drawn to a few points which have a bearing on the problem.

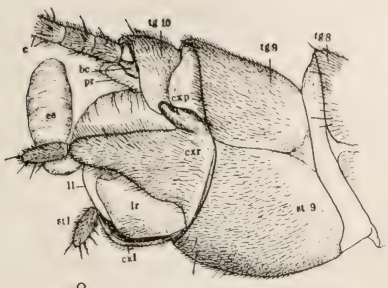
One of the most significant features possessed by the male is the remarkably primitive structure of the 9th abdominal sternum. In no other Pterygote insect, so far as I am aware, is there to be found an abdominal sternum consisting of sternite and separate, undivided coxites, each bearing a simple stylus. In some Ephemerids, such as *Blasturus nebulosus*, the 9th sternum of the male consists of sternite and separate coxites with styli, but either the styli or the apical part of the coxites are secondarily segmented, and even this condition is unusual, as the coxites in the Ephemerida are generally united to form a single plate.

It is in the Thysanura that we find abdominal sterna most nearly comparable to the 9th sternum of the male *Grylloblatta* in respect of the features mentioned. In certain genera of Lepismoidea (*Nicoletia* and *Atelura*) the 9th sternum of the female possesses, in addition to the stylus-bearing coxites (present in both sexes), a sternite overlapping the bases of the coxites.[5] In most of the genera of this order and of the Machiloidea, however, the sternite is absent from the 9th segment, but in the latter group the other abdominal sterna, or most of them, show all these parts, although the coxites are separate from the sternite, and basally from one another, only by sutures.

In this connection it may be added that *Grylloblatta* is interesting as giving additional support, if such be necessary, to the view that the lateral gonapophyses of the female are prolongations of the coxites of segment 9.

Thus in the structure of the 9th sternum of the male, *Grylloblatta* is not only more primitive than any other Orthopteroid insect, but also more so than the Plecoptera, Embiidina and Dermaptera (together constituting the "Panplecoptera" of Crampton) in all of which the division into sternite and coxites, and the styli, have been lost. It is also more primitive than any of the true Orthoptera in the absence of a subgenital plate in the female other than the

5. Escherich, K., Das System der Lepismatiden, Zoologica, 1905, Bd. 18, Heft 43, p. 25.



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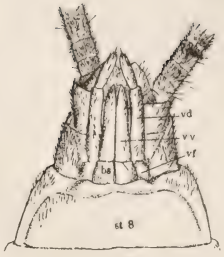

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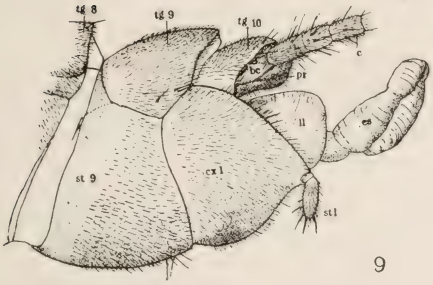

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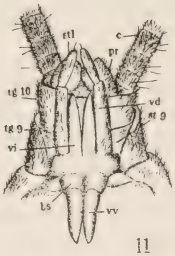

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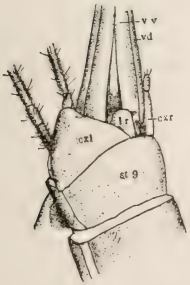

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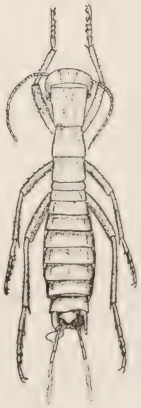

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GRYLLOBLATTA CAMPODEIFORMIS WALK.; STRUCTURAL DETAILS. (P. 138.)

unmodified 8th sternum, and in the details of the ovipositor, which are yet to be described. The immature ovipositor is of a distinctly more primitive type than that of the most generalized Orthoptera of corresponding stage, e. g., *Ceuthophilus* of the Tettigoniidæ. This is seen in the form and position of the valvulæ, the presence of well-marked styli and the more definite basivalvulæ. In these respects it approaches the Blattidæ and Mantidæ, but the valvulæ of the 9th segment have not the terminal position, nor have the dorsal valvulæ the broad, flattened form found in these groups, in which respects they are apparently the more primitive, at least at this stage. The great reduction or complete loss of the ovipositor in the Panplecoptera is, of course, a secondary feature, in which they are negatively specialized, as compared with the majority of Orthopteroid groups.

The male genitalia considerably resemble those of certain Blattoidea and Mantoidea, and also the Phasmoidea, and the fundamental plan of structure seems to be the same in all of these groups, although I believe the asymmetry has been independently acquired in some of them, at least. The true Orthoptera seem at first sight to be constructed upon an entirely different plan, but further investigation tends to indicate that it is a very highly modified form of the same plan.

It is my present opinion that the "Panisoptera" (Blattoidea, Mantoidea and Isoptera), which is unquestionably a natural assemblage, and the Orthoptera together with the Phasmoidea, represent two main branches of the same stem, originating as a section of the Palaeodictyoptera, and that Grylloblatta is the sole survivor of a twig which separated from this stem before the two main branches had become differentiated. The Phasmoidea also separated very early from the Orthopteran branch. The characters in which Grylloblatta and the Phasmoidea resemble the "Panplecoptera" are all primitive ones, and only indicate the common origin of the two stems.

The five-jointed tarsi, which are present in Grylloblatta, the Blattoidea, Mantoidea and Phasmoidea, are characteristic of primitive Orthopteroid insects, but I agree with Crampton's suggestion that the trimerous type may be, after all, the more primitive for the Class Insecta in general. We never find pentamerous tarsi in the Apterygota, nor in any of the Panplecoptera, so that they were probably acquired very early in the Orthopteroid stock, and probably also in other branches of the Palæodictyoptera. The reduced number of tarsal joints in the Isoptera and true Orthoptera is doubtless a secondary feature.

Explanation of Plates VIII and IX.

Abbreviations.

atg 10—arm of 10th tergite.
bc—basipodite of cercus.
bs—basivalvula.
c—cercus.
cxr, cxl—right and left coxites.
cxp—process of right coxite.
es—eversible sac.
lm—laminæ forming part of clasping apparatus.
lr, ll—right and left lobes of phallus.
pm—chitinous process of right lobe of phallus.
pr—paraproct.
sa—supra-anal plate.
st 9—9th sternite.
tg 9, tg 10—9th and 10th tergites.
vd—dorsal valvula.
vf—valvifer.
vi—inner valvula.
vv—ventral valvula.

Plate VIII.—*Grylloblatta campodeiformis*, terminal abdominal segments and genitalia of male. 1, adult, dorsal view; 2, same, ventral view; 3, same, caudal view; 4, same, ventro-caudal view; 5, nymph, stage A, ventral view; 6, nymph, stage B, ventral view; 7, same, caudal view.

Plate IX.—*Grylloblatta campodeiformis*. 8, adult male, right lateral view of terminal abdominal segments; 9, left lateral view of same; 10, female nymph, ventral view of terminal segments; 11, same with ventral valves bent forward to show inner valves; 12, diagram of probable method of coupling; 13, adult male dorsal view; 14, male nymph, stage A; 15, male nymph, stage B.

THE MAY-FLY OVIPOSITOR, WITH NOTES ON *LEPTOPHLEBIA* AND *HAGENULUS*.*

BY EMILY REED MORRISON, WASHINGTON, D.C.

The biological and morphological information contained in this paper was obtained from field trips made at Cornell University in the early summer of 1917, and from a laboratory study of the material thus collected and of related forms in the University collection. The work was undertaken at the suggestion of Dr. J. G. Needham who called the writer's attention to this may-fly and to the unusual structure present on the seventh and eighth abdominal segments of the adult female, and suggested that it might prove an interesting subject for a summer's study, an examination of other related species perhaps revealing similar modifications heretofore unnoted. For this original suggestion and for subsequent additions and corrections to the work, the writer is greatly indebted to him.

This species was first described by Dr. Needham (3) as *Choroterpes betteni* from specimens which had been collected by Dr. Cornelius Betten near Hamburg, N. Y., in 1906. Only adults were available for study at that time, and the species was doubtfully referred to the genus *Choroterpes*. Ten years later Dr. Needham found a swarm of little red may-flies near McLean, New York, which upon examination proved to be the same species; and in the nearby stream were the reddish-brown nymphs which he suspected to be its immature form. An examination of the nymphs showed that they belonged to the genus *Leptophlebia*. The observations and breeding work of the writer confirmed Dr. Needham's opinion that both nymphs and adults were the same species, *Leptophlebia betteni*.

Habitat.

The local habitat of this species is rather unique. It lies in the midst of a series of peat and grass bogs which are located near McLean, New York. Both the fauna and flora of this region are extremely localized, owing to the peculiar manner of the formation of peat bogs. The water in the streams which run through the peat bogs is of a deep coffee colour. It is in such a coffee-coloured stream which runs from a pond in the midst of the bogs that the nymphs of *Leptophlebia betteni* live, on logs which have dropped into the stream and have become water soaked and partially rotted. The brown nymphs were found in the longitudinal fissures of these logs, and so closely do they resemble the wet wood in colour that it is impossible to distinguish them when they remain motionless. On the logs with them may be found numerous Parnid beetles,

*Contribution from the Entomological Laboratory of Cornell University.
June, 1919

Bryozoans and fresh water sponges, together with the comb-horned fish fly, *Chauliodes;* the green may-fly, *Baetis;* Chironomid larvæ; the stone fly *Perla;* such caddis worms as *Hydropsyche;* and the Hydrophilid beetle, *Hydrobius globosus.* This may-fly is also extremely localized in habitat for the imagos were found for a distance of only about twenty feet and were abundant for only about six feet. The immature forms were found in the stream opposite this place of greatest abundance. At this point the stream bed breaks into gentle riffles in which lives the mollusk, *Anodonta footiana,* in some numbers. Just above the riffles the stream bed changes abruptly to soft, black ooze which is filled with another mollusk, *Sphærium.*

The writer visited the stream on the 25th and 30th of June, hoping to find the may-flies swarming, and if possible to observe mating and oviposition. However, the season had been late and cold and there were no swarms, although the nymphs were transforming; both subimagos and adults were clinging to the herbage and shrubs along the stream. Although no egg masses could be found, there were many of the small brown nymphs on the water-soaked wood, and from some of these which were carried into the laboratory it was possible to rear both sub-imagos and adults.

Description of the Stages.

Egg.

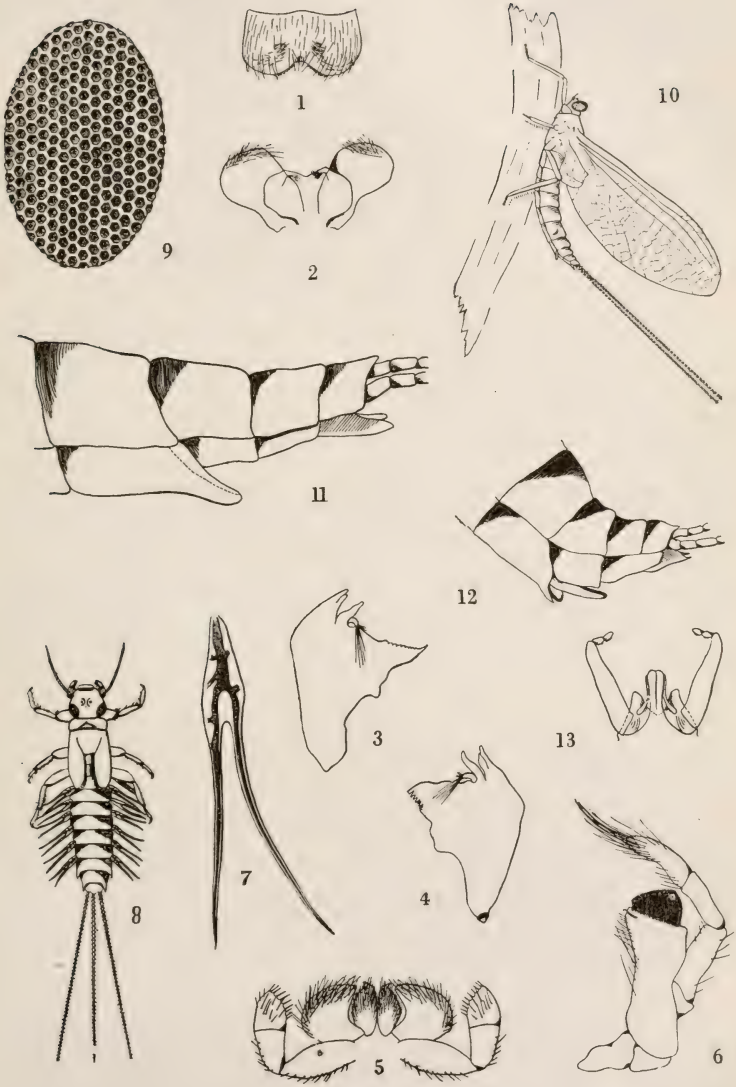
A dissection of the ovaries of a female of this species showed the presence of about six hundred eggs. The following description was made from material thus obtained. The egg (Pl. X, Fig. 9) is broadly ovate, .195 mm. long, by .11 mm. wide. The surface of the egg shell is laid off in numerous minute hexagonal areas with depressed centres. The dissected material was translucent whitish, and it was necessary to stain the shell to bring out the reticulation clearly.

Nymph.

The fully grown nymph (Pl. X, Fig. 8) is 7 mm. long with the three anal setæ 4 mm. long and subequal, and the antennæ 1.7 mm. long. The body is elongate, slender, flat below and slightly convex above. It is widest at the mesothorax, while the prothorax is slightly narrower than the head. The wing pads project posteriorly over the margins of the first two segments of the abdomen. The abdomen is long and narrow, twice as long as the head and thorax combined, widest at the sixth segment and with segments eight and nine produced posteriorly at each lateral margin into a triangular spine, while the caudal margins of segments nine and ten bear a fringe of spines dorsally. The deeply bifurcate abdominal gills are present on the lateral margins of segments one to seven and are all approximately equal in length, with broad basal portion about half as long as each of the slender terminal filaments. The body above is reddish brown in colour and slightly lighter beneath.

Mouth Parts of the Nymph.

The labrum (Pl. X, Fig. 1) is larger than wide and rather deeply incised medially, while on the under surface are a number of fine hairs which aid in straining food particles from the water. The mandibles are very roughly and irregularly triangular in shape, with the articulation and muscle attachment occupying about half of the base and with a group of large, erect fangs



LEPTOPHLEBIA BETTENI (NEEDHAM) AND L. PRÆPEDITA EIN.(?)

projecting at right angles to the axis of each mandible near its apex, while just within this group of fangs is the much smaller movable endopodite, terminating in a tiny brush of differentiated long and short hairs. The molar surface of the right mandible (Pl. X, Fig. 4) is situated on the lateral margin, while that of the left mandible (Pl. X, Fig. 3) is on the outer anterior margin. Each maxilla (Pl. X, Fig. 6) is made up of a basal portion, the cardo, which is roughly broad-triangular in shape and apparently divided into two sclerites. A united galea, lacinia and stipes, oblong in shape, more or less constricted in the middle, with apex diagonally truncate and the base rounded off on the inner side, is apparently attached to both sclerites of the cardo. A short suture at the inner apical corner of this combined sclerite marks the only differentiation between the galea and lacinia, while these structures cannot be separated from the stipes. A thick brush of long, fine hairs borders the truncate distal margin of the galea. The four-segmented palpi are attached about midway on the outer margin of this combined sclerite, with the basal segment minute tringular and the remaining segments elongate cylindrical. The second and fourth palpal segments are subequal in length, the third is a little shorter. The apical segment terminates in a cluster of hairs nearly as long as the segment. The labium (Pl. X, Fig. 5) consists of a ligula divided into oval glossæ and much wider paraglossæ, a pair of large, three-segmented labial palps, and a very much reduced and undifferentiated mentum, submentum and palpifer. The glossæ are clothed, except at the base with short, fine hairs, have a row of short, stout spines on the lateral margin, and terminate at the apex in a hook-like spine. The hairs on the distal portion of the paraglossæ are much longer than those on the glossæ. The apical segment of each labial palpus possesses a row of rather stout hairs on its inner margin, while there are finer hairs on the outer margins of the basal segments. The hypopharynx (Pl. X, Fig. 2) which normally lies closely applied to the labium, is divided into a central piece and two large lateral lobes which have long, fine hairs on their distal portions, while there are two short tufts close to the median margin of the central piece.

Adult.

(Pl. X, Fig. 10).

Dr. Needham (3) has described the adult as follows:—

"*?Choroterpes betteni*

"Length 5–6 mm.; expanse 10–11 mm.; setæ of the male 5–6 mm., and of the female 4½–5 mm.; colour nearly uniform, dark reddish brown, slightly paler on the middle abdominal segments in the female; wings hyaline, veins pale brown; legs yellowish brown, hind femur with two darker bands, fore femur of the female wholly dark; setæ pale yellowish with brown rings, three in number, equal; forceps of the male pale brownish, darker beneath with one very long basal and two very short apical joints."

Male Genitalia.

The male genitalia follow the general plan of structure which is constant in all of the species of *Leptophlebia* which were examined. They (Pl. X, Fig. 13) consist of paired penes placed between the forceps, each limb of which is made up of one long stout, slightly tapering basal segment and two small oval terminal segments, equal in size. The penes form an unjointed lobe-like pro-

tuberance, about half the length of the basal forceps arm, the paired arrangement, which shows distinctly in other species, being indicated only by a deep median cleft. The sperm ducts terminate in a pair of openings at the end of the paired lobes, while from below the middle of each margin there projects upwards and outwards as far as the base of the lobe, an elongate slender structure, slightly clavate near the apex.

So very distinct are these variations in structure that they may be used to separate the species. Thus in *Leptophlebia mollis* (Pl. XI, Fig. 11, 12) the basal portion of the basal forceps segment is decidedly enlarged and there extends from each of the divided penes a distinctly sword-shaped protrusion.. And in a form closely resembling *Leptophlebia præpedita** (Pl. XI, Fig. 13, 14) there is a small, additional segment at the base of each forcep limb, and the penes are long with a proportionately smaller lateral extension.

The Ovipositor in May-flies.

That a modification of the abdominal segments about the egg-valve, (that is ventrally between segments seven and eight) exists in certain may-flies, has previously to the description of *L. betteni*, been noted apparently by but two other workers. Dr. Hagen (2) seems to have been the first to note the presence of any such modification, for he states (p. 2) "Some of the females have a rounded egg-valve at the antepenultimate abdominal plate;" and again in characterizing the genus *Potamanthus* which included the *Leptophlebia* of modern writers, he states (p. 17) that the egg-valve is long. Dr. Eaton (1) in his Monograph of the Ephemeridæ, (p. 2) makes the following statement:—

"In the female the oviducts terminate separately in the joining of the seventh and eighth segments; there is no real ovipositor, but in some genera (e. g., *Heptagenia*) the apex of the seventh segment is produced into a short, rounded flap, and in one *Hagenulus* this projection takes the form of a spout."

In order to determine if this modification existed in any other forms, the writer made an examination of several species of the genus *Leptophlebia*, of the related genus *Choroterpes*, and the genus *Heptagenia*, all of which had been collected near Ithaca, New York. In *Choroterpes* and *Heptagenia* no trace of such a condition could be found, but in two species of *Leptophlebia* other than *betteni* there was a marked differentiation in the ventral structure of segments seven and eight between which the egg-valve opens. *Leptophlebia mollis* shows the simplest condition in this respect. The ventral portion of segment seven extends backward very slightly, as compared with the other abdominal segments, to form a broad truncated lobe, under which lie the two openings of the oviducts. Plate XI, Fig. 10 shows the ventral aspect of the abdomen at this point. In the centre of segment seven are two prominent conjoined ganglia (*n*) on either side of which lies an oviduct (*o*) filled with eggs, opening beneath the lobe. The modification of segment eight consists of two rounded chitinous ridges, converging posteriorly, covered with small

*"This is the *Leptophlebia præpedita* (?) Etn. of Needham's 'May-flies and Midges of New York" (N. Y. State Mus. Bull. 86, pp. 49-51, 1904, Pl. 11, Fig. 1, 2) and the nymph is there described. The gills lack the basal tracheal stubs that are shown in both the forms figured in this paper."—J. G. N.

spinules, with a concave area between the ridges, placed on the anterior third of the segment and extending nearly to the truncate lobe of the seventh segment. In *Leptophlebia submarginata* these last mentioned ridges are closer together and shorter and completely covered by a mid-ventral triangular prolongation of the apex of segment seven.

In *Leptophlebia præpedita* (?) (Pl. X, Fig. 11) the posterior portion of the seventh abdominal sternite is still more elongated, extending outward and backward so as to be distinctly visible from the side. Segment eight is but slightly modified. *Leptophlebia betteni* shows a further specialization in which both segments seven and eight are conspicuously involved (Pl. X, Fig. 12). The greatest development occurs in segment eight, the expanded portion of which is extended ventrally into a long and narrow, distinctly ovipositor-like organ the tip of which is quite heavily chitinized and basally into a short egg guide. A backward prolongation of segment seven forms with segment eight a channel for the passage of the eggs. An internal dissection showed that the oviducts, extend to the egg-valve and open separately at its base. One species of *Hagenulus*, which is found in Cuba has a much longer ovipositor-like extension (Pl. XI, Fig. 8) than has *Leptophlebia betteni*. A female specimen of this form, which is in the Museum of Comparative Zoology at Cambridge, Mass., was kindly loaned by Dr. Nathan Banks, and upon examination it was found that segment seven extends beyond the apex of the abdomen, folding together toward the tip in a tubular form with an opening on the upper surface. Three chitinous ridges extend along the under surface, converging to the tip. The oviducts extend and open separately, the eggs passing into the ovipositor in two strings whose identity is lost as they pass out of the aperture in a cylinder.

No nymphs of the genus Hagenulus have hitherto been made known; but a specimen collected by Professor C. F. Baker in Cuba and sent to Dr. Needham, in whose slide collection it now appears, dissected and mounted, has enabled the writer to present herewith Figures 1 to 7 of Plate XI. Noteworthy are the inequilateral gills, the form of both labial and maxillary palpi, and most remarkable of all, the extraordinary lateral extension of the labium, its breadth greatly exceeding that of the head.

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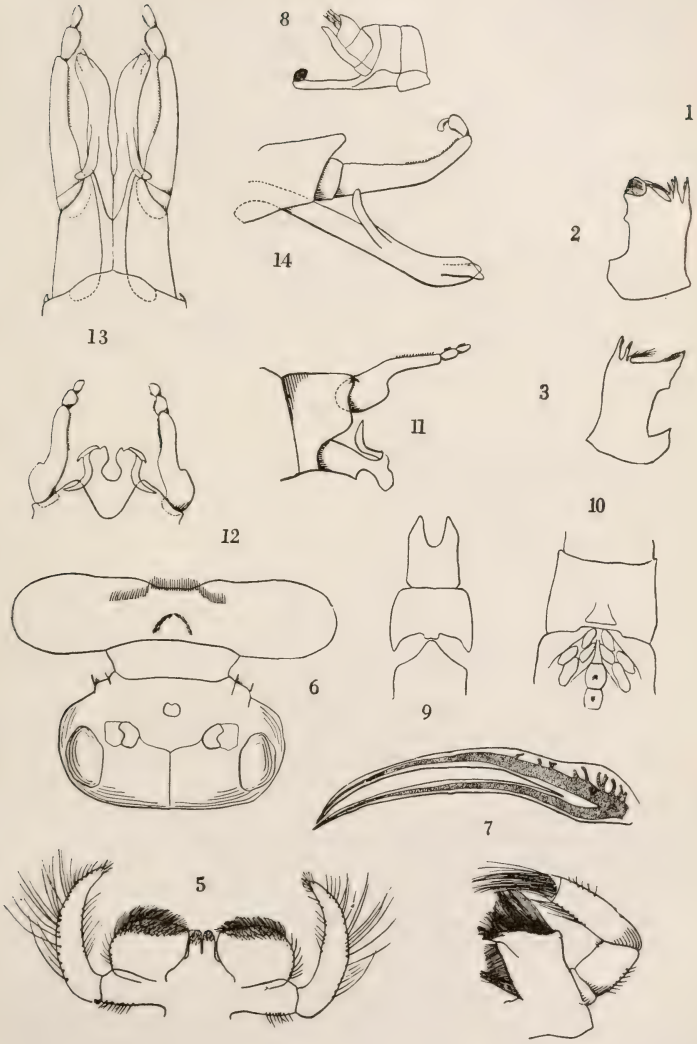


HAGENULUS AND LEPTOPHLEBIA; STRUCTURAL DETAILS.

Explanation of Plates.

Plate X.

Leptophlebia betteni.

Figure 1. Labrum of nymph.
" 2. Hypopharynx of nymph.
" 3. Left mandible of nymph.
" 4. Right mandible of nymph.
" 5. Labium of nymph.
" 6. Maxilla of nymph.
" 7. Abdominal gill of nymph.
" 8. Fully grown nymph.
" 9. Egg.
" 10. Adult female.

Leptophlebia præpedita (?).

" 11. Lateral view of end of abdomen of female.

Leptophlebia betteni.

" 12. Lateral view of end of abdomen of female, showing an egg partly extruded between the prolongations of segments 7 and 8.

Plate XI.

Hagenulus sp.

Figure 1. Hypopharynx of nymph.
" 2. Right mandible of nymph.
" 3. Left mandible of nymph.
" 4. Maxilla of nymph.
" 5. Labium of nymph.
" 6. Head and labium of nymph.
" 7. Inequilateral abdominal gill of nymph.

Hagenulus caligiatus.

" 8. Lateral view of end of abdomen of adult female, showing ovipositor bearing extruded egg-mass at its tip.

Leptophlebia submarginata (European).

" 9. Ventral view of segments 7, 8 and 9 of female, 7 and 8 being slightly separated to show prolongations that form the egg-guide.

Leptophlebia mollis.

" 10. Ventral view of segments 7 and 8 of adult female.
" 11. Lateral view of male abdominal appendages.
" 12. Dorsal view of male abdominal appendages.

Leptophlebia præpedita (?).

" 13. Dorsal view of male abdominal appendages.
" 14. Lateral view of male abdominal appendages.

DELPHACIDÆ OF THE BRITISH MUSEUM—ERRATUM.

On p. 7, line 16, for "3, Pundaluoya simplex Dist." read "3, Pundaluoya simplicia Dist."

F. Muir.

THE PROPLEURA AND THE PRONOTAL SULCI OF THE ORTHOPTERA.

BY E. MELVILLE DUPORTE, MACDONALD COLLEGE (MCGILL UNIVERSITY).

A few months ago while studying the musculature of *Gryllus pennsylvanicus*, I was impressed by the evident homology of the muscles of the meso- and metapleura with those attached to what I then thought was simply an entopleural apodeme of the prothorax. It occurred to me that this process might really represent the propleuron which externally is limited to a small triangular sclerite in front of the coxa. Examination of other Orthoptera convinced me of the correctness of this view. Recently Crampton* has shown that in *Dissosteira carolina* the pleural region is not "crowded out" but overgrown by the pronotum. This is the first published observation on this peculiar condition in the Orthoptera, and it has induced me to collect and publish my own notes on the subject.

I was pleased that Dr. Crampton in his paper drew attention to the misapplication of the terms *prescutum*, *scutum*, *scutellum* and *postscutellum*, in reference to the areas of the pronotum cut off by the sulci. Since it is generally accepted that the sclerites of the meso- and metathorax to which these terms are applied developed as a consequence of the growth of wings on these segments, and since there is no evidence that the prothorax has ever borne wings it is evident that the pronotal areas cannot be homologous with those of the hinder segments.

I hope to show that the overgrown pleuron is general throughout the Orthoptera (*sens. str.*), and that the sulci of the pronotum are integumental folds which originated as the result of mechanical stress.

a. The Propleuron.

The Acridiidæ (Pl. XII, Figs. 1–3, 12).

Rhomalea microptera. (Figs. 1 and 2). Externally the episternum is visible as a small, triangular sclerite (Fig. 1, est.) protruding from beneath the anterior half of the ventral edge of the pronotum. The position of the overgrown region of episternum is indicated externally by a darker pigmented and more densely punctate area on the pronotum in front of the third sulcus, and its anterior edge is outlined by a lightly impressed dotted line (Fig. 1). The pronotum can be lifted and cut away from the episternum without difficulty as the two are not very closely united. From within the episternum appears as a triangular sclerite with a convex anterior edge. It extends dorsad nearly half way up the pronotum. Its posterior edge lies against the third sulcus and is inflexed, uniting with the similarly inflexed anterior edge of the epimeron to form the entopleurite (Fig. 2, entp.), a triangular ridge which at its apex near the ventral edge fuses with entosternite or furca. A similar entopleural ridge is formed in the meso- and metathorax of this and other orthopterous insects (cf. Fig. 13, entp. 2).

The *epimeron* (Figs. 1 and 2, epm.) is a very narrow sclerite hardly visible externally except at its junction with the episternum. Its position, like that of the episternum, is indicated externally by a more densely punctate area at

*Crampton, G. C., The Thoracic Sclerites of the Grasshopper, *Dissosteira carolina*, Ann. Ent. Soc. Am., vol. XI, p. 347, Dec., 1918.

the ventral edge of the pronotum. It tapers posteriorly to a point which is attached near the posterior ventral angle of the pronotum.

Much the same conditions are found in the other Acridiidæ examined, viz., *Melanoplus*, *Dissosteira*, (Fig. 3) *Stenobothrus*, *Chortophaga*, *Camnula* and *Acridium*.

The Tettigidæ. (Figs. 4 and 5).

Tettix granulatus. A notch in the edge of the pronotum exposes a very small portion of the ventral edge of the episternum (Fig. 4, est). Internally the appearance is similar to that of the Acridiidæ. The episternum narrows more abruptly and the epimeron is shorter and more narrowed posteriorly. The entopleurite is thin and quite deep. The entosternal arch (Fig. 5, ents.) fuses with the entopleurite near its dorsal end and not, as in the Acridiidæ, near the ventral end.

The Locustidæ. (Figs. 6, 7 and 8).

Conocephalus (Fig. 6). Externally a very small, triangular portion of the episternum may be seen lying cephalo-laterad of the coxa. The greater portion of this sclerite, however, lies on the inner side of the pronotum extending more than half way towards the dorsal median line. The anterior edge is inflexed slightly and almost parallel with the posterior edge; the dorsal edge is rounded. The entopleural ridge projects ventrally and articulates with the coxa. At the dorsal end of the pleuron the epimeron is represented by a very small, narrow sclerite. At the ventral end there is a short, narrow, rod-like sclerite projecting backwards in much the same position as the epimeron in the Acridiidæ but very much more reduced.

The pleural regions of *Xiphidium* are very similar to those of *Conocephalus*.

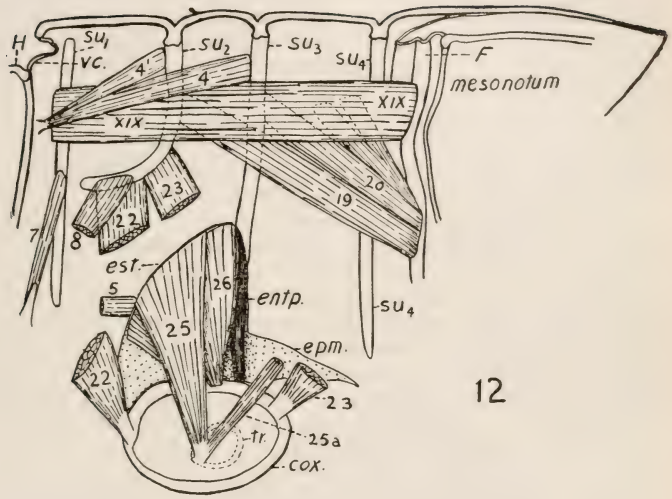
Microcentrum (Fig. 7). Here the episternum is triangular, tapering dorsally. The epimeron is very narrow and, as a free sclerite, is confined to the dorsal half of the pleuron. It projects dorsally some distance beyond the episternum.

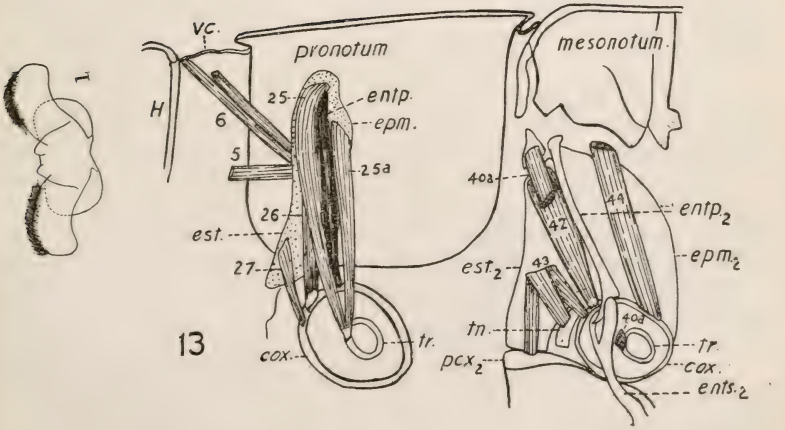
Ceuthophilus maculatus (Fig. 8). The episternum is broad and deeply bilobed. The entopleural ridge is strong and curved; the epimeron is very narrow, widest at the dorsal end and extending almost to the ventral edge of the pronotum.

The Gryllidæ. (Figs. 9, 10, 11).

Gryllus pennsylvanicus (Figs. 9 and 10). The pleuron extends dorsad almost to the median line. It is irregular in shape, and as it follows the curve of the pronotum is itself pronouncedly curved. The episternum is narrow but well developed, and the ventral edge projects slightly below the pronotal edge. The entopleural ridge is deep and projects ventrally, articulating with the coxa by a ball and socket joint. The epimeron is narrow and is best developed dorsally. It does not descend as far as the ventral edge of the pronotum.

Œcanthus nigricornis (Fig. 11). In Œcanthus the pleuron is completely overgrown by the pronotum. The anterior ventral angle projects slightly beyond the membranous integument (shown by the dotted line) connecting the pronotum and the sternal sclerites, so this small portion of the episternum can be seen on the ventral side beneath the flange-like edge of the pronotum. The episternum is broadly oblong. The entopleural ridge is narrow and but





PROPLEURAL AND PRONOTAL SULCI OF ORTHOPTERA.

(Page 153.)

slightly raised; as in the Locustids and in the other Gryllids it projects ventrally and articulates with the coxa. The epimeron is very narrow, almost as deep as the episternum and practically uniform in width except at the ventral end, where it projects farther caudad. It is entirely an internal sclerite.

In the insects described it is possible to trace a distinct gradation in the development of the propleura as ental sclerites. In the Acridiidæ (Figs. 1–3) the ventral end of the pleuron had undergone but little change and still stretches from the anterior to the posterior end of the prothorax. The epimeron is greatly reduced dorsally, much more so than the episternum. It is possible to lift the edge of the pronotum and show that the episternum is a continuous sclerite overgrown by the pronotum. In the Tettigidæ (Figs. 4, 5) the epimeron is still further reduced. In the Locustidæ (Figs. 6–8) the ventral end of the epimeron no longer extends to the posterior end of the segment but is gradually disappearing, the last vestige of it remaining in the Conocephalinæ (Fig. 6). After this we find the epimeron reduced to a very narrow sclerite, best developed dorsally. In *Ceuthophilus* (Fig. 8), except for the broad anterior lobe the pleuron closely resembles that of the Gryllidæ (Figs. 9 and 10). In the Locustidæ and Gryllidæ, unlike the Acridiidæ, the episternum is fused with the ventral edge of the pronotum and (at least in the Gryllidæ) have only a muscular attachment with the inner face of the pronotum, so that the internal portion of the pleuron has the appearance of a process of the small externally visible portion of the episternum; only by comparison with the Acridiidæ, and by a study of their musculature in comparison with that of the hinder segments of the thorax can their true nature be definitely ascertained.

The Musculature of the Propleuron. (Figs. 12 and 13).

The reason why the propleuron has persisted in spite of the fact that its position and function as an external lateral wall of the prothorax has been usurped by the overgrowing tergite, probably lies in the fact that important muscles of the leg arise from its inner surface. As fewer of these muscles arise from the epimeron this sclerite is accordingly more reduced than the episternum.

If we examine the mesopleuron of *Gryllus* (Fig. 13) we find the following muscles arising from the episternum.

40a. *From* the basalar sclerite, a detached portion of the episternum, *into* the anterior edge of the trochanter. An extensor of the femur.

42. *From* the dorsal edge of the episternum *into* the anterior edge of the coxa. An extensor of the coxa.

43. *From* near the middle of the sclerite *into*, (1) the precoxale, (2) the trochantin, and (3) the anterior edge of the coxa. An extensor of the coxa.

The pro-episterum of *Rhomalea* and *Gryllus* (Figs. 12 and 13) show homologues of these muscles as follows:—

25, homologue of 40a; 26, homologue of 42, and 27, homologue of 43.

From the proepimeron a single muscle 25a originates. It is inserted into the anterior edge of the trochanter. I have not yet found its homologue in the hinder segments.

A similar homology exists between the muscles of the propleuron and those of the metapleuron.

b. The Sulci.

Rhomalea microptera (Figs. 1, 2 and 12), having four well developed pronotal sulci gives good material for a study of these structures. The first sulcus (su_1) lies a very short distance behind the anterior edge of the pronotum and does not quite extend either to the median carina or to the ventral edge of the pronotum. The three other sulci all cut the median carina; the second (su_2) runs about half way down the pronotum and curves forward; the third extends to the ventral edge, and its lower half is coincident with the entopleural ridge formed by the infolding of the contiguous edges of the episternum and epimeron; the fourth runs from the median carina almost to the postero-ventral angle of the pronotum. An examination of Figure 12 will show that the first sulcus lies near the line where the infolded integumental membrane of the anterior end of the pronotum merges into the cervical membrane, and marks the furthest point to which the head may be retracted within the prothorax. This sulcus may be regarded then as marking the extremity of the primitive prothorax, the portion of the pronotum in front of this being probably a later developed growth forming a flange to receive and protect the retracted head. The anterior sulcus represents the fold which would naturally be formed when this flanking piece is pushed back by the retracted head. That this is the case is shown in *Tettix granulatus* (Fig. 5) where the prosternum has grown forward, completing the flange formed by the pronotum. In this insect the anterior notal sulcus is continuous with a sternal sulcus (s.su) which marks the position of the anterior end of the sternum in other Orthoptera.

A similar explanation accounts for the origin of the fourth sulcus (su_4).

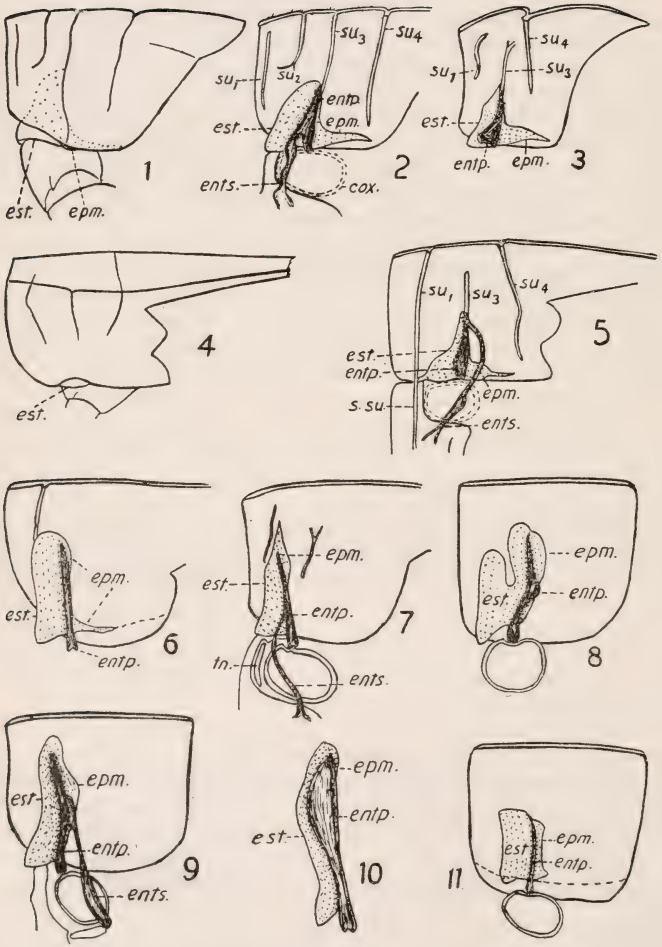
As Crampton (1.c.) has pointed out, the third sulcus originated with the infolding of the contiguous edges of the pleural sclerites to which it is closely attached. This accounts for the origin of the lateral portion of the sulcus, and it will be noted that in *Dissosteira* and many other insects this sulcus does not extend to the dorsal portion of the pronotum. The dorsal portion of this sulcus in *Rhomalea* arose as a result of the pull of the muscles which are attached to it, viz., one head of the third pronotal muscle (20) and one of the elevator of the head (4).

The origin of the second sulcus (su_2) is also due to the pull given the integument by the muscles attached to it. These muscles are an elevator of the head (4), a rotator of the head (8), one head of the third pronotal muscle (19), and an extensor of the coxa (23).

At the time the sulci were formed the integument was probably more flexible and less highly chitinized than it is at present. The method of origin of the second sulcus is well illustrated in the condition which now obtains in the flexible sutural membrane between the pro- and mesonotum. Here the pull of the first (XIX) and third (19, 20) pronotal muscles has produced a distinct fold in the integument (Fig. 12 F.). The hardening of this membrane would undoubtedly produce a sulcus exactly similar to those of the pronotum.

Summary.

1. The propleuron in the Orthoptera has not been forced out by the downgrowing notum, but has persisted on the inner side of the pronotum which has grown over it.



PROPLEURAL AND PRONOTAL SULCI OF ORTHOPTERA.

(Page 153.)

2. The episternum, epimeron and entopleural ridge can be easily distinguished though in most cases greatly modified.

3. The pleural sclerites have probably persisted because of their muscular attachments.

4. The musculature of the propleuron is similar to that of the mesopleuron and metapleuron.

5. The sulci are integumental folds formed by mechanical stress due to (a) the pulling of the head and mesothorax against the pronotum, (b) the in folding of the pleural suture, and (c) the pull of the prothoracic muscles attached to them.

Reference Lettering.

cox.	coxa.
epm.	epimeron.
entp.	entopleurite.
ents.	entosternite.
est.	episternum.
F.	fold in sutural membrane.
H.	base of head.
pcx.	precoxale.
s. su.	sternal sulcus.
su.	sulcus.
tn.	trochantin.
tr.	trochanter.
vc.	veracervix.

Muscles.

4. Elevator of head.
5. Retractor of head.
6, 7, 8. Rotators of head.
19, 20, XIX. Retractors of the pronotum.
22, 26, 27, 42, 43. Extensors of the coxa.
23. Flexor of the coxa.
25, 25a, 40a. Extensors of the femur.
44. Depressor of the wing.

Explanation of Figures.

Fig. 1. External view of the pronotum and propleuron of *Rhomalea microptera*.
" 2. Internal view of same.
" 3. Internal view of pronotum and propleuron of *Dissosteira carolina*.
" 4. External view of pronotum and propleuron of *Tettix granulatus*.
" 5. Internal view of same.
" 6. Internal view of pronotum and propleuron of *Conocephalus*.
" 7. Same of *Microcentrum*.
" 8. Same of *Ceuthophilus maculatus*.
" 9. Same of *Gryllus pennsylvanicus*.
" 10. Anterior view of detached propleuron of *G. pennsylvanicus*.
" 11. Internal view of pronotum and propleuron of *Oecanthus nigricornis*.
" 12. Musculature of the propleuron and pronotal sulci of *Rhomalea microptera*.
" 13. Musculature of pro- and mesopleuron of *Gryllus pennsylvanicus*.

Change of Name.—Prof. R. W. Dawson, of Lincoln, Neb., who is making a special study of the genus *Serica* informs me that my *Serica carinata* (Coleoptera of Indiana, 1910, p. 950) is preoccupied by *Serica carinata* Burmeister (Handbuch IV, 2, p. 175). I, therefore, propose for my Indiana species the name *Serica evidens*, sp. nov.

W. S. Blatchley.

NORTH AMERICAN SARCOPHAGIDÆ: FLIES OF GENUS METOPOSARCOPHAGA TOWNSEND.*

BY R. R. PARKER, BOZEMAN, MONT.

The writer described the species *Sarcophaga pachyprocta* in 1916 (Jour. N. Y. Ent. Soc., vol. 24, pp. 171–175). In connection with the description it was noted that the species was considered to represent a form separable from *Sarcophaga* and possibly should be placed in a distinct genus, but the writer refrained from so doing till it was possible to examine other closely related species. In 1917, however, Townsend made this species the genotype of *Metoposarcophaga* (Proc. Biol. Soc. Wash., vol. 30, pp. 46) but mentioned no other species as belonging to the genus. In the same paper (p. 43) *Sarcophaga incurva* Aldrich was made the genotype of *Thelyleptococnema*. It is the writer's opinion, however, that the two species are congeneric and *Metoposarcophaga* is hereby designated as the name of the genus. *M. tothilli* and *M. pachyproctosa*, new species of the genus, are described in this paper.

The following characters are common to the males of all four species:—parafrontals and genæ silvery grey; front broad, very prominent in profile; vestiture of back of head black or with some light coloured hair close to foramen (in *pachyprocta*); lateral verticals present, greater ocellars as strong or stronger than uppermost pair of frontals; frontal bristles not numerous (six to seven, sometimes eight or nine); epaulet dark; anterior acrostichals well developed; scutellar apicals absent or weak and hair-like; lower sternopleura with bristles only; vestiture of nota of short reclinate bristles that become longer and more slender ventrally; vestiture of fourth ventral plate erect; posterior surface of anterior tibia with two bristles about one-third from distal end (only one in *Sarcophaga* and *Ravinia*); first genital segment much larger than second and its vestiture longer; marginal bristles absent; forceps slender, bent so that prongs are at a pronounced angle to the base; accessory plate at side of forceps (not anterior to them as in Ravinia, etc.), erect and hiding at least part of base of forceps (in *tothilli* and *incurva* only tip of forceps visible from side); claspers on each side united basally (not separate as in Ravinia, etc.); posterior clasper with variously shaped expanded base with bristle at upper anterior angle, distally with a curved hook.

The genus quite naturally divides into two groups, the *pachyprocta* group, containing *pachyprocta* and *pachyproctosa*, and the *incurva* group containing *incurva* and *tothilli*.

The *pachyprocta* group is distinguished by the following characters:—three pairs posterior dorsocentrals; scutellar apicals absent; first vein bristly; costal spine present; posterior tibiæ of normal length; ventrally sides of fourth notum with marginal bristles only; profile of genital segments as in Fig. 1; first genital segment grey pollinose. The penes and claspers very similar but not alike, forceps essentially the same.

Characters of *incurva* group:—four pairs posterior dorsocentrals (sometimes five); scutellar apicals, if present, weak and hair-like; only third vein bristly; costal spine vestigial; posterior tibia much shorter than femur or tarsus; ventrally sides of fourth notum clothed with long, slender bristles; profile of

*Contribution from the Entomological Laboratory of the Montana State College, Bozeman, Mont.

June, 1919

genital segments as in figure 2; first genital segment dull orange, darkened anteriorly; claspers and forceps are essentially alike in both species.

Examination of the figures shows that there is a fundamental likeness in the structure of the accessory genital parts of all four species.

TABLE OF SPECIES.

1. Four or more posterior dorsocentrals, posterior tibia very short.....2.
   Three posterior dorsocentrals, posterior tibia of normal length.....3.
2. Posterior femur normal, tibia short, but not distorted .....*tothilli*, n. sp.
   Posterior femur very large with protuberance beneath bearing a "brush," tibia short and distorted.....*incurva* Aldrich.
3. Anterior clasper reversed S-shaped, penis on long, slender base.....*pachyproctosa*, n. sp.
   Anterior clasper with distal hook and large expanded base, penis on short base.....*pachyprocta* (R. Parker).

Metoposarcophaga tothilli, n. sp.

Holotype (male).—Collection of R. R. Parker.

Male.—Parafrontals and genæ silvery grey; vestiture of back of head black except for some light coloured hairs just below foramen (difficult to see); lateral verticals present, greater ocellars well developed, section III of costa about equal to section X; leg vestiture short; anterior face of posterior femur with only upper row of bristles complete; posterior tibiæ very short, much shorter than either femur or tarsus; anterior acrostichals present; four pairs posterior dorsocentrals (sometimes five); genital segments dull orange except that first is darkened anteriorly.

Length 6–10 mm.

Head viewed from side parafrontals and genæ with dark reflections; transverse impression same colour as genæ. Breadth of front at narrowest part about three-fifths eye width; cheek height approximately three-sevenths that of eye. Front very prominent; width of frontal vitta variable but at narrowest part of front at least twice width of each parafrontal. Second antennal segment dark; third about twice length of second; arista short plumose about to middle. Vestiture of back of head black. Gena with scattering hairs above, below with a row close to lower eye orbit.

Chætotaxy.—Lateral verticals present; vibrissæ inserted slightly above line of oral margin; greater ocellars well developed; frontal rows of bristles extending to or slightly below base of vitta, the lower few pairs divergent from edges of vitta.

Thorax.—Vestiture of mesonotum black, cilia-like, slightly reclinate.

Wings.—Anterior cross-vein more basal than end of first longitudinal; third vein bristly; costal spine vestigial; section III of costa practically equal to section V; calypters whitish, fringed with white hair.

Legs.—Dark, vestiture short. Anterior face of posterior femur with complete upper row of bristles, intermediate row absent, lower row with a few rather weak distal bristles; tibia very short, beardless, about three-fourths length of femur, much shorter than tarsus, middle femur without "comb."

Chætotaxy.—Well developed. Anterior acrostichals present; inner presuturals absent; four pairs posterior dorsocentrals (sometimes five); prescutellar

acrostichals present; scutellar apicals absent or scarcely differentiated; three sternopleurals; lower sternopleura with bristles only.

Abdomen.—Rather short. Clothed above with short, reclinate bristles, beneath with longer, more erect hair; on each side ventral portion of fourth notum clothed with long, slender bristles (not confined to edge as in most species of *Sarcophaga*); ventral plates not rounded posteriorly, fourth clothed with erect hair.

Chætotaxy.—Second segment without marginal bristles or, if present, short, decumbent and inconspicuous; third with two, sometimes very weak; fourth with complete marginal row.

Genital Segments.—Both dull orange except that first is darkened anteriorly. First much the larger, marginal bristles absent: second, flattened, vestiture shorter than that of first; anal area small. Forceps slender, abruptly curved

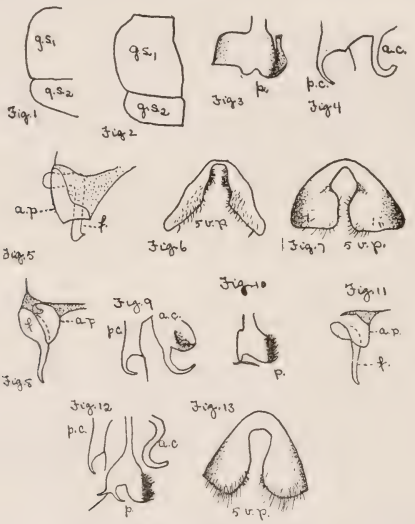


Fig. 22.—*Metoposarcophaga* spp., male genitalia. (Page 157.)

at right angles to the basal portion, distal end slightly enlarged with a short tooth directed forward; forceps in profile view except tip concealed by accessory plate. Penis and accessory parts almost identical with those of *M. incurva* Aldrich.

Described from nine male specimens.

Range.—British Columbia; Savary Island, July 13, 18, 20, 31, 1917, (R. S. Sherman, collector). Holotype taken in same locality and by same collector on July 18, 1917.

The writer has two females which are obviously either *M. incurva* or *M. tothilli* and though the posterior tibia is shorter than the tarsus, it is not as short as in the males of these species nor does it present the peculiar structural modifications found in *M. incurva.*

Metoposarcophaga pachyproctosa, n. sp.

Holotype (male).—Collection of R. R. Parker.

Allotype (female).—Collection of R. R. Parker.

This species is so close to *M. pachyprocta* that a repetition of the description is unnecessary. So far as observed the only reliable differences between the males of the two species are to be found in the characters of the genitalia as here listed.

M. pachyproctosa.

1. Anterior clasper reversed S-shaped (Fig. 12).
2. Penis distinctive, but with long, slender base (Fig. 12).
3. Fifth ventral plate distinctive (Fig. 13).

M. pachyprocta.

1. Anterior clasper with broad expanded basal portion (Fig. 9).
2. Penis distinctive, with short base (Fig. 10).
3. Fifth ventral plate distinctive (Fig. 7).

In addition the second genital segment of *pachyproctosa* is dull orange throughout, and there is a narrow, posterior, dull orange band on the first segment, whereas in *pachyprocta* the second segment is more or less greyish pollinose and the grey pollen of the first segment extends to the middle portion of the posterior margin, at least. These characters may well be variable, however.

I have three females collected in the same locality as the above males. These females are not separable from those of *pachyprocta*, but this species has never been found in several lots of materal from Savary Island. The females are therefore assumed to be those of *pachyproctosa*.

Described from two male and three female specimens.

Range.—British Columbia; Savary Island, July 9, and Aug. 11, 1916. July 11 and 12, 1917, (R. S. Sherman, collector).

M. pachyprocta is known to occur in Mass., N. Y., N. J., Pa., Va., N. C., S. C., Ga., La., Ind., Ohio, Col., S. D., Calif., Manitoba, Cuba (?) and Hayti (?): *M. pachyproctosa* and *M. tothilli* are known only from British Columbia: *M. incurva* occurs in N. Mex., Mont., and British Columbia.

Explanation of Figures.

1. Profile view of genital segments of *M. pachyprocta* R. Parker and *M. pachyproctosa*, n. sp.
2. Profile view of genital segments of *M. incurva* Aldrich and *M. tothilli*, n. sp.
3. Penis of *M. tothilli.*
4. Claspers of *M. tothilli.*
5. Forceps and accessory plate of *M. tothilli.*
6. Fifth ventral plate of *M. tothilli.*
7. Fifth ventral plate of *M. pachyprocta.*
8. Forceps and accessory plate of *M. pachyprocta.*
9. Claspers of *M. pachyprocta.*
10. Penis of *M. pachyprocta.*
11. Forceps and accessory plate of *M. pachyproctosa.*
12. Claspers and penis of *M. pachyproctosa.*
13. Fifth ventral plate of *M. pachyproctosa.*

Abbreviations.

a. c. anterior clasper.
p. c. posterior clasper.
a. p. accessory plate.
f. forceps.
p. penis.
g. s. 1 and g. s. 2 first and second genital segments.
5 v. p. fifth ventral plate.

A NEW CISIDE GENUS WITH NEW SPECIES FROM MANITOBA.

BY CHARLES DURY, CINCINNATI, OHIO.

Dolichocis, new genus.

This genus is proposed for a species of narrow and elongate form, having a combination of the characters of *Cis* and other described Ciside genera. It has the antennæ 9-jointed, the elytra finely beaded along suture. The prothorax at side edges strongly margined and finely serrate.

Dolichocis manitoba, n. sp.

Elongate, narrow, oval in form. Brownish piceous in colour, when mature. Vestiture of rather sparse, pale setæ. Punctures deep and strong, those of prothorax closer and finer than those of elytra. Head—epistoma subtruncate and margined. Palpi thick, with terminal joint oval and blunt at tip. Prothorax as long as wide, with sides rounded, margined and with finely serrate edges. Elytra two and one-fourth times as long as wide. Beneath the prosternum is flat between coxæ, and long before them. Fore tibiæ not produced at outer tip. Males with a sharp, round fovea on first ventral. Length 2 mm.; width 07 mm.

Aweme, Manitoba. Norman and Talbot Criddle. From fungus growing on ash and elm. Twenty specimens; in the Canadian National Collection at Ottawa, Ont., and in my collection at Cincinnati, Ohio.

Cis criddlei, new species.

Elongate, with sides straight, colour piceous, vaguely paler on posterior third. Vestiture of conspicuous hairs arranged without order. Head with epistoma truncate and narrowly reflected. Prothorax as wide as long, sides feebly rounded. Hind angles viewed from above almost right angled. Punctures dense and deep. Elytra twice as long as wide, more sparsely and coarsely punctured than the prothorax. Beneath, the male has a large fovea on first ventral segment. Length 2 mm.; width 1 mm.

Aweme, Manitoba. Norman Criddle. Eight specimens; in Canadian National Collection at Ottawa, Ont., and my collection, Cincinnati, Ohio. This species is the size and shape of *Cis wenzeli*, but differs from that and all other species known to me in structural characters.

ON SOME TINGIDÆ NEW TO THE FAUNA OF CANADA (HEMIP.).

BY CARL J. DRAKE, SYRACUSE, N.Y.*

Corythucha salicis Osborn and Drake.

Specimens of this insect were taken on willow, *Salix discolor*, at Aweme Manitoba, Aug. 13, 1918, by Mr. N. Criddle; other specimens were collected at Trenton, Ontario, Sept. 11, 1910, by Mr. Evans. From the United States specimens are at hand from Montana, Wisconsin, New York, Massachusetts and New Jersey. The known food plants are willow, *Salix* spp., and currants; *Ribes* sp.

Corythucha elegans Drake.

Mr. H. Groh took a few specimens of this species at Ottawa, Ontario, Oct. 13, 1908, on poplar, *Populus balsamifera;* two specimens were collected in Ontario, July 27, 1903, by Mr. Evans. One specimen is before me that bears the locality label "Mich." The type specimens are from Colorado. During the summer of 1917 and 1918 the writer noted hundreds of specimens, adults, nymphs and eggs, on willow in the vicinity of Cranberry Lake, New York.

Corythucha padi Drake.

Chilliwack, British Columbia, collected by Prof. F. C. Ewing. This insect breeds upon the western choke cherry, *Prunus demissa*. Specimens have been examined from Oregon, Washington, Idaho and Montana.

Corythucha parshleyi Gibson.

Several specimens, collected on walnut (*Juglans nigra*), butternut (*Juglans cinerea*), Japanese walnut (*Juglans sibboldiana*) and juneberry (*Amaelanchier intermedia*). It is a common insect in the eastern part of United States, ranging from Canada to North Carolina.

Corythucha heidemanni Drake.

Two specimens, collected at Ottawa, Canada, by Mr. W. H. Harrington. This is a common insect that infests birch in the vicinity of Cranberry Lake, New York.

Corythucha betulæ Drake.

Two specimens from Ottawa, Canada, collected by Mr. Harrington. Thousands of specimens, adults, eggs and nymphs, have been seen by the writer on yellow birch, *Betula lenta*, in Adirondack Mountains, near Cranberry Lake, New York, during the summers of 1917 and 1918. Two specimens have also been examined from Maine.

Corythucha immaculata Osborn and Drake.

Lillooet, British Columbia, collected by Mr. A. W. A. Phoir. This species infests balsam root, *Balsamorrhiza sagittata*. Specimens are at hand from Oregon, Washington, Idaho, Montana and California.

Corythucha hewitti, new species.

Four specimens, taken on hazelnut, *Corylus americana*, October 8, 1918, at Aweme, Manitoba, by Mr. N. Criddle. Length 2.78 mm.; width 1.5 mm. *Type* and *paratype* in the National Collection of Insects, Entomological Branch, Ottawa; *paratype* in the author's collection. Named in honour of Dr. C. Gordon Hewitt, Dominion Entomologist.

Hood moderately elevated, the length slightly less than twice its height.

*Contribution from the Department of Forest Entomology, the New York State College of Forestry, Syracuse, New York.

Median carina slightly raised anteriorly; outer carinæ normal. Spines moderately long, the tips dark fuscous. Reticulations of the hood moderately large, slightly larger than those of the paranota. Tumid elevations of the elytra normal; costal area triseriate, the outer margin slightly concave.

A small spot on the paranota, another on the median carina, and greater part of the dorsal portion of the hood dark fuscous. Body beneath blackish, sometimes slightly tinged with reddish. Nervures whitish. Elytra with a band across the base, another near the apex, a spot on the paranota, part of the inner portion of sutural area dark fuscous. The apical band of the elytra without large hyaline cells; some cells with tiny hyaline centres. Legs and antennæ yellowish white.

Readily separated from the hazelnut tingid, *Corythucha coryli* Osborn and Drake, by the much less elevated hood. Akin to *C. bellula* Gibson, from which it may be distinguished by slightly longer spines, the globose portion of the hood being much less narrowed dorsally and not distinctly angulate at the crest, darker colour pattern, the apical band of elytra without large hyaline areolæ.

DESCRIPTIONS OF FOUR NEW PARASITIC HYMENOPTERA.

BY S. A. ROHWER, BUREAU OF ENTOMOLOGY, WASHINGTON, D.C.

Tetrastichus rugglesi, new species.

Female.—Length 1.75 mm. Subopaque dark blue, without sculpture; intraocellar line subequal with the ocellocular line; antennæ eight-jointed; one ring joint a three-jointed funicle and two-jointed club; funicle joints subequal in length and subequal in length with the pedicle; club one-fourth shorter than two funicle joints, pointed apically, the apical joint longer than the preceding one; mesonotum with a rather faint median furrow; scutellum with two well-defined furrows; propodeum smooth, shining; prepectus sculptured like mesopleure, i. e., smooth and shining; abdomen ovate, ovipositor sheath slightly exserted; costal margin of hind wing with one spine. Antennæ brown; scape, tibiæ and tarsi and narrow apices of femora yellowish-white (tibiæ somewhat infuscated medianly); wings hyaline, venation yellowish.

Type-locality.—University Farm, St. Paul, Minnesota. Described from eleven females (one type) reared as parasites of *Agrilus arcuatus* by A. G. Ruggles. Material reared July 24, 1916, (type), July 11, 1916, and September 16, 1915.

Type.—Cat. No. 22132. U. S. Nat. Mus.

Trigonura hicoriæ, new species.

Female.—Length 4.5 mm. Head with large umbilicate punctures; area between eyes about one-fourth greater than length of eye; antennal foveæ smooth; antennæ thirteen-jointed with one ring joint; ocellocular line slightly shorter than the interocellar line, and not much greater than the greatest diameter of a lateral ocellus; thorax with large umbilicate punctures, smaller and closer on the prothorax; the depressed area of mesepisternum in which the middle leg fits transversely striate; legs shining with very fine scattered punctures; hind femora with eight teeth, the three apical teeth close and smaller, the posterior one well removed from the others; abdomen shining, the apical segment with large, irregular setigerous punctures. Black; a yellowish spot on venter; four

anterior knees and all the tarsi yellowish-brown; wings hyaline; marginal and stigmatical veins black; a brown spot basad of stigma.

Male.—Length 4.25 mm. Except for usual differences, like female. Venter without yellow.

Type-locality.—Syracuse, New York. Described from two females and five males reared from *Hicoria glabra* by M. W. Blackman and H. H. Stage and under their numbers H-171 (type), H-114 (allotype), H-955, H-134, H-892, H-1367 and H-212.

Type.—Cat. No. 22093, U. S. Nat. Mus.

Ecphylus hicoriæ, new species.

Readily distinguished from related American species by its colour and sculpture.

Female.—Length to apex of abdomen 3 mm.; length of ovipositor 2.5 mm. Face granular and with irregular transverse, raised lines; frons and vertex with distinct transverse striæ; posterior orbits smooth; postocellar line about half as long as ocellocular line; antennæ 27-jointed, the third joint distinctly shorter than the fourth; pronotum with lateral angles prominent; prescutum punctured, and with a median impressed longitudinal line; notauli foveolate; scutellum without sculpture; propodeum coriaceous, reticulate in apical dorsal middle, a faint dorsal median longitudinal carina and a transverse carina at top of posterior aspect; recurrent interstitial with intercubitus; first tergite one-fourth longer than apical width, with distinct longitudinal striæ, these more prominent laterally so there is a triangularly-shaped median area which is not so coarsely striate, remaining abdominal segments smooth, polished. Black; abdomen beyond first segment rufous; basal joints of antennæ and legs yellowish-ferruginous; pronotum anteriorly and lower part of mesepisternum rufous (may not be constant); wings hyaline; venation dark brown.

Male.—Length 3 mm. Agrees with female except for usual differences.

Type-locality.—Syracuse, New York. Described from three females and one male reared from *Hicoria glabra* by M. W. Blackman and H. H. Stage, and recorded under their numbers H-972 (type , H-956, H-947 and H-118a allotype).

Type.—Cat. No. 22030, U. S. Nat. Mus.

In the male and in one female the frons are partly ferruginous.

Heterospilus blackmanni, new species.

Because of the colour and length of ovipositor this new species would be grouped with *consimilis* Ashmead, but the sculpture is quite different from that species.

Female.—Length to apex of abdomen 2.55; length of ovipositor 2.5 mm.; length of abdomen 1.25 mm. Head smooth, polished; ocelli in nearly an equilateral triangle; inner margins of eyes parallel, the distance between them somewhat greater than their length; antennæ, 20-jointed, the third joint about one-fifth longer than the fourth; scutum and prescutum shining, practically without sculpture; notauli well defined, not foveolate; suture in front of scutellum finely foveolate; scutellum smooth, shining; dorsal lateral areas of the propodeum polished, median carina distinct; posterior face of propodeum finely coriaceous; first tergite about one-sixth longer than apical width, with distinct longitudinal

striæ; base of the second tergite longitudinally aciculate; most of the second and all of the remaining tergites smooth, polished; mesepisternum smooth; sides of the propodeum sculptured like the posterior face; second abcissa shorter than the first intercubitus; recurrent slightly beyond the intercubitus. Black; mandibles, three basal joints of antennæ and the legs yellow; wings hyaline, venation pale brown, stigma somewhat darker.

Male.—Length 2 mm. Agrees well with female except the second tergite is yellowish.

Type-locality.—Syracuse, New York. Described from five females and one male collected by M. W. Blackman and H. H. Stage from *Hicoria glabra*, and recorded under their numbers H-107 (1 type), H-608, H-1141, H-118 and H-608a (allotype).

Type.—Cat. No. 22031, U. S. Nat. Mus.

NEW NEARCTIC CRANE-FLIES (RHYPHIDÆ AND TIPULIDÆ, DIPTERA) PART VII.

BY CHARLES P. ALEXANDER, STATE LABORATORY OF NATURAL HISTORY, URBANA, ILLINOIS.

Family *Rhyphidæ.*

Trichocera colei, new species.

Thoracic stripes indistinct; wings light grey, yellowish at the base, a faint brown cloud on *r-m;* male hypopygium conspicuously enlarged.

Male.—Length, including the hypopygium, about 7–7.5 mm.; wing 6 mm.

Rostrum and palpi dark brown. Antennæ of the male setaceous, black. Head dark grey.

Mesonotum brownish grey without distinct stripes, the posterior half of the scutellum yellowish; postnotum dark. Pleura dark brown, sparsely grey pruinose. Halteres pale, the knobs dark. Legs light brown, the coxæ, trochanters and bases of the femora paler. Wings with a faint grey tinge, the base of the wing yellowish; stigma brown, diffuse; a brownish cloud on *r-m*. Venation: *Sc* ending slightly before *r; R*$_{2+3}$ a very little longer than *R*$_2$ before *r*.

Abdomen dark brown, the incisures paler. Male hypopygium conspicuous, very large for this genus of flies. Pleurites with a group of setæ near the distal end on the inner face. Pleural appendage longer than the pleurite, at the apex enlarged into a blackened lobe which is densely covered with short, erect, yellowish hairs; on the dorsal inner face near the base of this lobe, a slender cylindrical arm. Penis-guard broad at the base, rapidly narrowed to the blunt tip. Gonapophyses in the form of two strongly divergent chitinized horns.

Habitat.—Oregon.

Holotype.—♂, Forest Grove, Washington Co., November 11, 1918, (F. R. Cole). Type in the collection of the author. Paratype.—♂, Vancouver, Washington, Dec. 12, 1918, (Wm. Giles); reared from turnips. In the collection of the U. S. National Museum, Chittenden, No. 2772.

The conspicuous male hypopygium will easily separate the fly from any of the known American species. The species is dedicated to Mr. Frank R. Cole to whom I am indebted for many favours.

June, 1919

FAMILY *Tipulidæ*.

Gonomyia (Gonomyia) mainensis, new species.

Related to *G. subcinerea* O. S.; thoracic pleura striped; abdominal tergites dark brown; male hypopygium with the outer pleural lobe rather short with its apex obliquely truncated; inner lobe bifid, with a posterior flattened blade.

Male.—Length about 5 mm.; wing 5.6 mm.

Head dark, discoloured in the type. Antenna broken.

Pronotum clear light yellow. Mesonotal præscutum pale brown, with three indistinct, dark brown stripes, the lateral margins light coloured; scutum pale brown, the lobes dark; remainder of the mesonotum brown. Pleura light yellow with two distinct, purplish brown stripes, the ventral stripe occupying the mesosternum. Halteres very long and slender, pale, the knobs darkened. Legs with the coxæ dull brownish yellow, darkened on the base of the outer face; remainder of the legs light brown, the tarsi darker. Wings with a faint greyish tinge; stigma darker; veins dark brown. Venation: *Sc* rather long, ending opposite about one-third the length of the radial sector; *Rs* very long, straight; R_{2+3} very long, R_2 correspondingly shortened; deflection of R_{4+5} punctiform; cell *1st* M_2 with the inner end slightly narrowed; basal deflection of Cu_1 beyond the fork of *M*.

Abdomen dark brown, the hypopygium yellowish. Male hypopygium with the outer pleural lobe stout, hairy, slightly darkened toward the apex, which is obliquely truncated and produced inwardly into a small tooth; inner appendage bifid, consisting of a posterior flattened blade terminating in a hook, with a single seta on its face; ventral lobe short, terminating in about two stiff setæ. Gonapophyses small, curved, strongly chitinized, in the unique type unequal.

Habitat.—Maine.

Holotype.—♂, Fort Kent, Aroostook Co., August 29, 1913. Type in the collection of the author.

Gonomyia mainensis differs conspicuously from *G. subcinerea* in its striped pleura, venation, and, especially, the very different structure of the male hypopygium.

Limnophila (Ephelia) angustior, new species.

Wings narrow, the brown markings confined to the vicinity of the veins; pleurites of the male hypopygium with a tuft of long, yellow hairs at the apex; outer pleural appendage with a prominent lateral tooth on the outer margin.

Male.—Length 6.5 mm.; wing 7.5–7.6 mm.

Female.—Length 8–8.4 mm.; wing 8.3 mm.

Similar to *L. superlineata* Doane, differing as follows:

Antennæ dark brown throughout. Mesonotal præscutum without a lateral brown line, the lateral stripes less distinct, the median stripe entire Wings very narrow, strikingly different from those of either *L. superlineata* or *L. aprilina*. Wings light grey with a dark brown and greyish brown pattern, the costal markings relatively small, much narrower than the interspaces; the markings on the disk take the form of narrow seams along the veins and cross-veins; veins dark brown, *Sc* and *R* more yellowish. Venation: the supernumerary cross-vein in cell *M* is inserted so that it lies beyond the end of the

2nd anal vein; the wing pattern is not so heavy as in *L. aprilina*. Male hypopygium with the pleurites moderately elongated, covered with numerous setæ that become very numerous along the basal inner two-thirds; outer apical angle of the pleurite a little produced and blackened, provided with a loose tuft of long, yellow hairs that exceed the pleural appendages in length. Outer pleural appendage slender, with a prominent tooth before the apex on the outer margin, distad of this with numerous appressed teeth and a small, stout apical spine. Inner pleural appendage fleshy, stout, blunt at the tip.

Habitat.—Colorado.

Holotype.—♂, Platte Cañon, Jefferson Co., altitude 10,000 feet, June 27, 1915, (E. J. Oslar).

Allotopotype.—♀.

Paratopotypes.—11 ♂ ♀.

Type in the collection of the author.

Limnophila (Ephelia) apiculata, new species.

Closest to *L. angustior;* pleurites of the male hypopygium without an apical tuft of hairs; outer pleural appendage straight, without a prominent lateral tooth on the outer margin.

Male.—Length, about 6.8 mm.; wing 7.2 mm.

Very similar to *L. angustior*, differing as follows:

Antennal flagellum with the basal segments light brownish yellow, passing into darker brown on the terminal segments. Mesonotum light grey with four dark brown stripes, the intermediate pair very long and separated by a capillary vitta of the ground colour. Dark tips to the femora and tibiæ less distinct. Wings slightly more yellowish, the brown pattern heavier but confined to the vicinity of the veins. Abdomen dull brownish yellow, with an indistinct, dark brown dorso-median stripe. Hypopygium more reddish. Pleurites moderately stout, without a conspicuous apical tuft of long yellowish hairs. Outer pleural appendage black, stout, the apical third along the outer margin with numerous, acute, appressed teeth, the terminal one extended into a free spine. Inner pleural appendage fleshy, pale, covered with numerous stout setæ, the apex narrowed and tipped with three or four setæ.

Habitat.—California.

Holotype.—♂, Alpine, San Diego Co., April 8, 1915, (M. C. Van Duzee).

Paratopotype.—♂.

Type in the collection of the author.

Limnophila (Ephelia) edentata, new species.

Closest to *L. superlineata* Doane; size small, wing of the male about 6.5 mm.; first segment of the antennal flagellum yellowish; wings with a heavy brown pattern, the outer four costal blotches confluent in pairs; outer pleural appendage of the male hypopygium without appressed lateral teeth on the outer margin near the apex.

Male.—Length 5.6 mm.; wing 6.5 mm.

Similar to *L. superlineata* Doane but differing in numerous regards: Size very small. First flagellar segment of the antennæ yellow, the remaining flagellar segments light brown. The median præscutal stripe is widely divided for its entire length; in addition to the narrow lateral stripes and a dark spot

at the margin of the sclerite, there is a small, brown line between the lateral and intermediate stripes that crosses the suture onto the scutal lobes. The femoral tips are broadly dark brown, but the tibial tips are but narrowly and indistinctly darkened. The wings are narrower with a much heavier pattern, the markings at *Sc*1 and *R*1, and at *R*2 and R3 being confluent behind; a few brown dots in the costal and subcostal cells between the larger blotches; petiole of cell *M*1 a little longer than this cell. Male hypopygium with the pleurites rather slender. Outer pleural appendage blackened, terminating in a long, curved hook whose outer margin is not minutely tooth as in many species of the subgenus; on the outer face before the tip with a stout spine; a small, blackened tubercule on the inner margin near the base of the appendage. Inner pleural appendage stout and broad, flattened, covered with numerous setæ.

Habitat.—California.

Holotype.—♂, Apline, San Diego Co., April 9, 1915, (M. C. Van Duzee).

Type in the collection of the author.

Eriocera saturata, new species.

Antennæ black, the scapal segments brighter; præscutum yellowish gray with four dark brown stripes, the intermediate pair narrow; wings reddish brown; cell *M*1 lacking; abdomen dark brown, the lateral margins broadly yellowish.

Female.—Length 13.5 mm.; wing 9.4 mm.

Rostrum short, light brown. Palpi black, the basal segments more brownish. Antennæ with the scapal segments yellowish brown above, reddish beneath; flagellum black. Head broad, brown, with an indistinct darker median area. Frontal tubercle dark brown.

Mesonotal præscutum yellowish gray with four dark brown stripes, the intermediate stripes very narrow, separated from one another by a distance a little less than the diameter of one; anterior portion of the scutal lobes dark; scutellum grey, with the extreme base darkened; postnotum grey. Pleura clear silvery grey, the dorsal pleural region dark brown. Halteres short, brownish yellow, the knobs dark brown. Legs with the coxæ pale brown, sparsely grey pruinose; trochanters brownish yellow; femora brownish yellow, narrowly darker at the tips; tibiæ and tarsi brown. Wings with a strong reddish brown suffusion, the colour being a little darker than in *E. californica* O. S.; a small, brown cloud on *r-m;* veins *Sc* and *R* brown, remaining veins dark brownish black; stigma indistinct. Venation: Cell *M*1 lacking; vein *M*1+2 beyond cell *1st M*2 longer than this cell.

Abdominal tergites dark brown, the lateral margins broadly yellowish. Ovipositor rusty red; sternites light brown, margined laterally with yellow.

Habitat.—California.

Holotype.—♀, Fallbrook, San Diego Co., August 2, 1917, (E. G. Holt).

Type in the United States Biological Survey collection.

E. saturata is closest to *E. velveta* Doane from which it may be told by its deep, saturated reddish brown wings with the stigma not darkened, the greater length of the veins issuing from cell *1st M*2, the colour of the abdomen and other characters.

Tricyphona macateei, new species.

Antennæ black; mesonotum yellowish grey, the præscutum with three stripes of which the median one is divided by a capillary pale line; wings nearly hyaline with a heavy dark brown and grey pattern, the mark at the origin of the sector running into the costal cell; abdominal segments indistinctly banded with yellowish.

Male.—Length 8–8.5 mm.; wing 7.8–8.6 mm.

Rostrum and palpi dark brownish black. Antennæ dark brownish black throughout, the intermediate flagellar segments short-cylindrical or almost rounded, the terminal segments smaller. Eyes broadly contiguous beneath, widely separated above. Head small, dark grey.

Mesonotal præscutum light yellowish gray, with three brown stripes, the median stripe more or less distinctly divided by a ground vitta, this pale stripe clearer behind; scutal lobes dark. Pleura gray with indistinct blotches of darker Halteres short, pale brown, the knobs dark brown. Legs with the coxæ dull yellow, the middle and posterior coxæ sparsely grey pruinose; trochanters dull yellow; femora brownish yellow, the tips broadly dark brown; tibiæ and tarsi dark brown. Wings almost hyaline with a heavy dark brown and grey pattern, this including about six larger markings along the costal margin, the first surrounding the humeral cross-vein, the second Sc_2, the third the origin of the sector, passing into the costal cell, the fourth mark at the tip of Sc_1; small, pale seams along the margin of the wing at the ends of the veins; narrow seams along the cord and *m*. Venation: Sc_2 about midlength between *h* and the origin of the sector; *Rs* very strongly arcuated at origin; cell M_1 shallow, its petiole longer than *m*; *m-cu* obliterated by the punctiform contact of Cu_1 and *M*.

Abdominal tergites indistinctly banded with dark brown and paler yellowish brown; sternites brown, the posterior half of each of the intermediate segments yellow. The male hypopygium shows the moderately powerful pleurites inclined toward one another so that the tips are contiguous, the apices with abundant blackened spicules.

Habitat.—Maryland.

Holotype.—♂, Beltsville, Prince George Co., October 7, 1917, (W. L. McAtee).

Paratopotype.—♂.

Type in the United States Biological Survey collection.

T. macateei is readily separated from *T. vernalis* (O. S.) by the uniformly dark antennæ, the almost hyaline wings with the pattern larger, darker and more clearly defined, the blotch at the origin of the sector including the costal cell, the short cell M_1 with a long petiole and other characters. This very interesting new species is dedicated to its collector, Mr. W. L. McAtee.

Tipula pendulifera, new species.

Belongs to the *cunctans* group; antennal flagellum dark brown; mesonotum light grey, the præscutum with four stripes; wings with a faint yellowish tinge, the stigmal region and wing-base more suffused; abdomen yellowish with a broad, dark brown median stripe; male hypopygium with a long, pendulous lobe at the ventral angle of each pleurite.

Male.—Length 17 mm.; wing 18 mm.

Female.—Length about 20–21 mm.; wing 18.5–19 mm.

Frontal prolongation of the head brownish grey. Palpi dark brown. Antennæ with the scape reddish brown, the flagellar segments uniformly dark brown. Head dark grey.

Mesonotal præscutum light grey with four greyish brown stripes; scutellum and postnotum clear light grey. Pleura heavily greyish white pruinose. Halteres light brown. Legs with the coxæ yellowish, sparsely grey pruinose; trochanters and femora light brown, the latter darkened at the tips; tibiæ yellowish brown, the tips darkened; tarsi brown. Wings with a faint yellow suffusion; base of the wing and the stigmal region yellowish, this latter including the apex of the costal cell, the apex of cell *1st* R_1 and most of cell *2nd* R_2; costal and subcostal cells brownish; veins dark brown. Venation: Petiole of cell M_1 short.

Abdomen yellowish; segment eight and the basal half of nine in the male dark brown; a very distinct, dark brown, median stripe on both the tergites and sternites; on the former it begins at about midlength of the first tergite as a narrow line, gradually widening behind; these stripes are continuous except for narrow yellowish silvery posterior margins to the segments. Male hypopygium with the sclerites fused into an almost continuous ring. Eighth tergite concealed beneath the seventh, except laterally. Ninth tergite extensive, the posterior margin with a broad median notch, the lateral angles subacute, blackened; on either side of the median line is a small obtuse knob; the ventral margin of the ninth tergite bears two median blackened points. Region of the ninth pleurite long and narrow. Outer pleural appendage broad and flattened, pale, very narrow at the base. Inner pleural appendage complicated in structure. At the ventral angle of each pleurite hangs a very long, pendulous lobe, pale, directed ventrad, slightly enlarged distally and here provided with long, coarse hairs; the dorsal end of this appendage is likewise slightly produced. Between these pendulous lobes a flattened, elongate oval disk is visible.

The female is similar to the male, differing in the sexual characters; the dorsal abdominal stripe is narrower and attains the end of the seventh tergite. Ovipositor with the tergal valves straight; sternal valves very short, high, obtusely rounded at their tips, a little more than one-half the length of the tergal valves.

Habitat.—Colorado (Saguache County).

Holotype.—♂, Cochetopa National Forest, Upper Saguache Ranger Station, September 7, 1917, (A. K. Fisher).

Allotopotype.—♀.

Paratopotypes.—3 ♀'s.

Type in the United States Biological Survey collection.

T. pendulifera is a well-defined species, allied to *T. cunctans* and *T. carinata*, from which it is easily told by its larger size, and the conspicuous pendulous lobes of the male hypopygium.

Tipula noveboracensis, new species.

Belongs to the *tricolor* group, closest to *T. caloptera* Lw.; antennal flagellum short, dark brown; wings with cells M_1, M_2, Cu_1 and most of M_3 brown; male

hypopygium with a powerful curved clawlike horn on either side of the median lobe of the ninth tergite.

Male.—Length, 18–22 mm.; wing, 20.5–25.5 mm.

Close to *T. caloptera* Lw., differing as follows:

Antennal flagellum short, darker, almost uniformly dark brown, the first segment a little paler.

Ground colour of the thorax, including the pleura, bright silvery white. Præscutal stripes darker, the lateral stripes more or less confluent anteriorly with the median stripe, the pale ground interspaces indicated near the suture. Wings with the brown markings darker and differently arranged: cell *1st* M_2 and the apical two-thirds of R_5 hyaline, cells M_1, M_2, Cu_1 and all but the extreme base of M_3 brown; in *T. caloptera* the white area includes the basal half of cell *1st* M_2, the bases of cells M_1, M_2 and M_3 and the apical half of cell R_5; the brown in the base of cell *M* is about equally extensive in the two species.

The abdominal pattern is more contrasted than in *T. caloptera*, the broad, lateral stripe being almost black; in the holotype, the ground colour of the tergites is yellowish on the first two segments only, on the remaining segments passing into grey; in the paratypes, however, the bright yellow colour persists to the fifth or sixth segments; in all cases the black, lateral stripes are narrowly connected across the caudal ends of the segments; the lateral margins of the tergites are broadly silvery, more buffy near the end of the abdomen. Male hypopygium conspicuously different from the other members of the *tricolor* group, the narrow, rectangular, somewhat depressed, median lobe with parallel sides being subtended on either side by a powerful, slightly curved clawlike horn which is sometimes slightly roughened.

Habitat.—Northeastern North America.

Holotype.—♂, Power-house Creek, near Gloversville, Fulton Co., New York, altitude 1,000 feet, June 24, 1916, (C. P. Alexander).

Paratopotypes, 2 ♂'s; *paratypes*, ♂, Ithaca, Thompkins Co., New York, May 12, 1915, (C. P. Alexander); ♂, May 24, 1898, pinned with the cast pupal skin; ♂'s, Beaver Dam, New Brunswick, June 23, 1914, (J. D. Tothill).

Type in the collection of the author.

The type and paratopotypes were found resting on small boulders projecting from the bed of a small mountain stream. The flight of these large, beautiful crane-flies is unusually vigorous for a member of this family.

Tipula calopteroides, new species.

Belongs to the *tricolor* group, closest to *T. caloptera* Lw.; antennal flagellum long, clearly bicolorous; mesonotal præscutum with the stripes dull grey, not distinctly margined with darker; wings with the base of cell *M* clear.

Female.—Length about 25 mm.; wing 25.3 mm.

Close to *Tipula caloptera* Lw., differing as follows:

Antennæ longer, distinctly bicolorous, the basal enlargement of the flagellar segments dark brown, remainder of the segments yellowish.

Mesonotal prescutal stripes dull grey, very indistinct, the usual dark margins scarcely evident; the brown median vitta very distinct. Wings with considerably more pale markings than in *T. caloptera*, more nearly approaching the type of *T. strepens;* the brown in the base of cell *M* practically lacking

excepting the usual broad brown seam along *Cu* and its branches; the pale pattern includes the base of cell *1st M*$_2$, apical two-thirds of cell R_5, base of cells M_1, M_2 and M_3, and the centre of cell Cu_1.

Abdominal tergites with the dark brown lateral stripes very broad, about as wide as the yellow mid-dorsal area, this latter most distinct on tergites one to seven.

Habitat.—North Carolina.

Holotype.—♀, Canton, Haywood Co., June, 1911.

Type in the collection of the author.

Tipula manahatta, new species.

Belongs to the *tricolor* group, closest to *T. sackeniana* Alex.; antennal flagellum light yellow throughout; mesonotum reddish brown with indistinct præscutal stripes; wings with a strong fulvous tinge with scarcely any pale areas on the membrane; abdomen reddish brown without darker stripes.

Male.—Length about 15 mm.; wing 15 mm.

Frontal prolongation of the head light yellowish on the sides, darker above, indistinctly lined with brown; palpi short, brown, the basal segments more yellowish. Antennæ moderately elongated, the scapal segments brown, the flagellar segments light yellowish throughout, the terminal segment brown. Vertex dark grey; occiput and a very narrow margin around the eye paler.

Mesonotum reddish brown, the præscutal stripes very indistinct; scutellum yellow. Pleura yellowish, the mesopleuræ faintly grey pruinose. Halteres dark brown, yellowish at the extreme base. Legs with the coxæ yellowish, faintly pruinose; trochanters yellow; femora and tibiæ reddish brown throughout; tarsi dark brown. Wings with a strong greyish fulvous tinge, the costal margin and a broad seam along *Cu* very broad, rich fulvous; there are scarcely any paler areas on the membrane, the obliterative streak extending about to mid-length of cell M_4; cell R_5, and the bases of the anal cells a little pale.

Abdomen reddish brown, the sides of the first segment more yellowish; abdominal tergites very narrowly and indistinctly ringed caudally with silvery. Male hypopygium as in the *tricolor* group, the sclerites of the ninth segment fused into a continuous compressed ring. Ninth tergite with the median lobe, prominent, depressed, slightly expanded distally, reddish, the extreme posterior margin minutely spiculose; margin of the sclerites between the tergal and pleural regions light yellowish. Outer pleural appendage large, fleshy, distinctly notched at its apex, covered with short dense hairs. Inner pleural appendage subchitinized, flattened, with a deep split that separates off a posterior hook or lobule whose posterior margin is grooved longitudinally into a scrobe; posterior margin of the anterior appendage with a high, flattened carina; apex broadly rounded. At the base and ventrad of the pleural appendage is a triangular lobe which is densely covered with a short, golden yellow pubescence and, ventrally, a number of long reddish hairs. Region of the ninth sternite extensive, the adjacent margins almost continuous, from between them projecting the straight, slender penis-guard and two small oval, flattened lobes.

Habitat.—New York (Suffolk County).

Holotype.—♂, Yaphank, Long Island, September 3–4, (Charles Schaeffer).

Paratopotype.—♂.

Type in the collection of the Brooklyn Museum.

Tipula phoroctenia, new species.

Belongs to the *marmorata* group, closest to *T. fragilis* Lw.; male hypopygium with the ninth tergite having a broad V-shaped notch; outer pleural appendage without a basal tooth; eighth sternite strongly projecting, shovel-like, the posterior margin shallowly notched and with a row of black, comb-like spines.

Male.—Length about 13 mm., wing 14 mm.

Similar to *T. fragilis* Lw. in most respects, differing as follows: The præscutal stripes are broader and less distinct, the intermediate pair extending a little farther cephalad, the grey thoracic interspaces narrower. The wings are a little narrower, with the dark pattern less distinct. The abdomen is light yellow with a narrow, dark brown sublateral stripe and silvery grey lateral margins. The ninth tergite and the sixth to ninth sternites are dark brown. The most conspicuous differences are to be found in the structure of the male hypopygium, the ninth tergite of which has a broad, posterior V-shaped notch the caudal margin blackened, with the lobes running out into slender, chitinized points, the space between with a few smaller elevations; lateral notches extensive, not so deep as in *T. fragilis*. Outer pleural appendage long, slender, somewhat flattened, without a distinct chitinized basal ridge or tooth as in most other species of the group. The fleshy lobes that arise near the ventral angle of the pleurites are very large so that they practically fill this portion of the opening of the genital chamber; they are pale reddish, covered with a short, dense pale pubescence. Ninth sternite with a broad square notch, from the base of which projects a stout, reddish rod, presumably the penis-guard. Eighth sternite extensive, projecting, the posterior margin nearly truncated with a very shallow notch, set with a row of short, black spinous teeth; extreme posterior lateral angles of the sternite with a few long yellowish hairs.

Habitat.—Maine.

Holotype.—♂, Orono, Penobscot Co., in a bog at the edge of a wood, October 3, 1913, (H. M. Parshley).

Paratopotype.—♂, indoors, October 16, 1913.

Type in the collection of the author.

Tipula nebulipennis, new species.

Belongs to the *marmorata* group, closest to *T. fragilis* Lw.; legs mostly brown with only the femoral bases yellowish; male hypopygium having the caudal margin of the ninth tergite with two flattened divergent lobes separated from one another by a very small notch; outer pleural appendage with a subacute shiny chitinized tooth; eighth sternite slighlty projecting, the posterior margin with a broad, U-shaped median notch.

Male.—Length 12–13 mm.; wing, 12.2–13.5 mm.

Frontal prolongation of the head dark grey, the sides more brownish. palpi short, brownish black. Antennæ with the scape yellow, the flagellum brownish black; flagellar segments only slightly enlarged basally. Head grey.

Mesonotal præscutum light grey with four brown stripes, the intermediate pair becoming indistinct anterior to the level of the pseudosutural foveæ; scutal lobes largely brown; scutellum and postnotum light grey. Pleura grey, clearer and lighter posteriorly. Halteres brown, the extreme base yellow. Legs with the coxæ light grey; trochanters light yellow; femora yellowish basally, soon passing into brown, the tip narrowly darker brown; tibiæ with the basal half light brown, the apical half darker brown; tarsi dark brown. Wing pattern and venation about as in *T. fragilis*, the stigma paler brown.

Abdomen with the first tergite grey pruinose, the other tergites brown with a broad, dark brown sublateral stripe, ringed posteriorly with yellowish, these rings broadest on the basal segments, becoming indistinct about the seventh segment; sternites one to five bright yellow, the basal segments a little darker laterally; remaining sternites dark brown. Male hypopygium with the ninth tergite rather large, divided into two apparent halves by a mid-dorsal impression; each half is produced caudad into an inner flattened lobe, separated from its mate of the opposite side by a very small and narrow notch, the lateral angle of each lobe slightly produced and with a few stout black setæ; the tergite is dark, the lateral margins yellowish, the apical lobes orange yellow and provided with a short, dense pubescence. Outer pleural appendage large, greyish, slightly curved, the outer face with appressed black hairs; near the base of the appendage a shiny, flattened, chitinized tooth. Inner pleural appendage compressed, flattened, extensive, near its base forming a cup-like hollow. An enlarged, dark-coloured, fleshy lobe provided with numerous pale hairs lies on either side near the ventral angle of the pleurite, extending dorsad along the opening of the genital chamber; the outer basal margin of this lobe is light yellow in colour. Eighth sternite slightly projecting, the posterior margin with a large, shallow, broadly U-shaped notch, the lateral angles of which are provided with long whitish hairs, the outer basal margin of this lobe minutely spinulose, light yellow beneath.

Habitat.—Labrador.

Holotype.—♂, Battle Harbour, August 1, 1912, (G. P. Engelhardt).

Paratopotype.—♂.

Type in the collection of the Brooklyn Museum.

Tipula fragilina, new species.

Belongs to the *marmorata* group, closest to *T. fragilis* Lw.; legs darkened, the femora with a broad, yellowish subterminal ring before the black tip; male hypopygium having the ninth tergite with a wide V-shaped notch; outer pleural appendage with a blunt, blackened basal lobe; eighth sternite carinate, the posterior margin with a very deep and narrow median notch, the margins contiguous or nearly so and provided with long, yellowish hairs.

Male.—Length about 13 mm.; wing 13.3 mm.

Female.—Length about 13 mm.; wing 13 mm.

Generally similar to *T. fragilis* Lw., differing as follows: The intermediate stripes of the præscutum are broader and extend further cephalad; the ground colour between the intermediate and lateral stripes narrower. Pruinosity of the pleura darker. Legs darker, the black femoral tips broader and with a

distinct yellow subterminal ring. Hypopygium darker coloured. The most striking differences between this and the related regional species are found in the male hypopygium, as follows:

Ninth tergite dark coloured, with a deep, impressed mid-dorsal line; posterior margin with a wide V-shaped notch, the lateral lobes formed terminating in blackened chitinized points, the lateral notches only slightly concave, larger and not so deeply rounded as in *T. fragilis*. Outer pleural appendage long, slightly flattened, not as stout as usual in the group, pale, almost white in colour, the basal third slightly contracted and produced proximad into a blunt, blackened lobe. Inner pleural appendage a pale, almost white, compressed blade, on the posterior margin near the base bearing a small knob provided with numerous short, black setæ. At the ventral angle of the pleurite, jutting dorsad across the face of the genital chamber as a long, slender, slightly sinuous lobe tapering to a point, densely covered with white hairs; this structure is considerably larger than the corresponding one in *T. fragilis*. Ninth sternite with a deep notch which is slightly enlarged at its base, the sides parallel or nearly so. Eighth sternite compressed, with a very deep median notch, the adjacent lobes contiguous apically, though separated basally, provided with long, yellow hairs. In *T. fragilis*, the eighth sternite is spade-shaped, unnotched.

Habitat.—Alaska. (Iditarod River Country).

Holotype.—♂, Flat, September 6, 1917, (A. N. Twitchell).

Allotype.—♀, Bethel, September 24, 1917, (A. N. Twitchell).

Type in the United States Biological Survey collection.

Nephrotoma euceroides, new species.

Generally similar to *N. eucera* (Lw.) from which it differs as follows: Average size much smaller (male, length 14–14.2 mm.; wing 13.8–15 mm.). Male antennæ with only 17 evident segments. Thoracic stripes distinct, reddish brown, much darker than in *N. eucera*. Wings with a more greyish yellow tinge, the stigma poorly defined, pale. Abdomen darker, brownish yellow, the hypopygium brown. Male hypopygium with the ninth tergite having the caudal margin evenly rounded with a small, narrow median notch whose nearly contiguous lateral angles are produced beneath into blackened lobes which are densely spiculose. Eighth sternite with a broad, deep posterior notch, the median area of the sternite not so densely hairy as in *N. eucera*.

Habitat.—Northeastern North America.

Holotype.—♂, Sport Island, Fulton Co., New York, altitude 750 feet. June 16, 1910, (C. P. Alexander).

Paratype.—♂, Perth, New Brunswick, June 15, 1915, (F. M. McKenzie).

In general appearance, *N. euceroides* is very similar to *N. breviorcornis* (Doane) from which it is most easily told by the number and structure of the antennal segments.

Mailed July 8th, 1919

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POPULAR AND PRACTICAL ENTOMOLOGY.

COLLECTING TERRESTRIAL ARTHROPODS IN BARBADOS AND ANTIGUA, BRITISH WEST INDIES.

BY DAYTON STONER, IOWA CITY, IOWA.

I. Barbados.

The data upon which the following notes are based were secured by the writer and Mrs. Stoner during the time spent on the islands of Barbados and Antigua as members of the Barbados-Antigua Expedition sent out by the University of Iowa in the spring of 1918. The time between May 9 and June 17 was spent at Barbados. Collecting at Antigua was done between June 19 and July 19.

The island of Barbados is situated in 13° 4′ North latitude and 59° 37′ West longitude, and is the most easterly of the Antillean chain. It is about twenty-one miles long by fourteen broad, with an area of 166 square miles and a population of about 200,000, nine-tenths of which is black. The strata forming the basement series of Barbados consist of siliceous and calcareous sandstones and clays. About six-sevenths of the total area of the island is covered by a cap of coral rock which is more or less flat, and rises in a series of terraces to Mt. Hillaby in the "Scotland district," which is 1,104 feet in height. An area of approximately 6,000 acres at the northern and eastern side of the island has received that name on account of its peaked and hilly character. The remainder of the island is low and flat or at most slightly rolling, with few swamps and marshes and but two or three fresh water streams of any importance. Practically all the tillable land is under sugar cane, and but few remnants of the forests which once covered the island now remain. The annual rainfall is about sixty inches, and usually comes in the form of showers during the summer months. The dry season occurs in the winter and early spring months.

On account of the slight physiographic differentiation, the almost uniform state of cultivation and the density of the population, Barbados is not a particularly favorable place for collecting insects. In addition, practically all the grass land is closely grazed by goats and cattle, so that dense growths of vegetation are much restricted. In general the affinities of the insect fauna are with that of South America, but a number of North American and closely allied forms are to be found. A few indigenous forms also occur.

Whenever the entomologists started out on a collecting trip, the fact was quickly noised abroad that strange people were collecting butterflies. How the news spread so quickly was somewhat of a mystery in view of the fact that telephone service is seldom available to the blacks. But in a short while groups of children and older persons as well would put in their appearance and express a desire first to know what we were going to do with the insects, and suggesting as a probable answer that perhaps they were to be made into medicine. Having been more or less satisfactorily appeased by our answers, the second thought was to be of assistance—for a consideration. After a few usually vain attempts

to secure the particular insects desired the youngsters desisted in their efforts to capture specimens, but often continued to follow at a safe distance to view the strangers. Not always were the followers peaceable, for on one occasion the entomologist was followed for a considerable distance over the hills of the Scotland district by an ever-increasing mob of black children, who drew others from far and near by their shouts of "A German spy." On another occasion the writer was taken for an escaped lunatic, and three big black fellows armed with a rope were making ready to capture the luckless "bug man" and escort him within the four walls of the nearby lazaretto. However, the persuasive powers of the intended victim were sufficient to permit him to continue unmolested.

Among the men in "Little England" who take a special interest in entomology and who did much to aid us were Mr. Wm. Nowell, Mycologist in the Imperial Department of Agriculture; Dr. J. C. Hutson, the then Acting Entomologist in that Department, and who was taking the place of the regular Entomologist; Mr. H. A. Ballou, then absent in Africa on special economic investigations, and Mr. J. R. Bovell, Entomologist in the Colonial Department of Agriculture. Rev. N. B. Watson, of St. Lucy's Parish, one of the delightful old-time naturalists, has a fine collection of native insects, and Sir Gilbert Carter, a former Governor of Barbados, has in his beautiful home an excellent collection of native Lepidoptera.

A few of the principal collecting places may be briefly referred to here. One of the chief places frequented by insects of various kinds is the more or less protected series of terraces referred to above. Here on the side next the sea the vegetation is somewhat sheltered from the direct rays of the sun, and the more delicate shrubs, small trees, weeds and Solanaceæ in particular offer a plentiful supply of food for plant-feeding insects, many kinds of which were taken in the sweep net.

The high, dry flats between these terraces are often thickly overgrown with the long, dense, sour grass which, however, is harsh and supports few insects other than grasshoppers.

It was indeed a pleasure to meet with one of our old friends, *Megilla maculata* along with many other less well-known forms of Coleoptera, as well as an abundance of Hemiptera in the small ditches scattered over the island. These are usually grown over with grass and weeds, and in them, during heavy rains, the water flows in torrents; shortly thereafter they again become dry, but the stimulus given the vegetation by the more than usual amount of water keeps it continually green and fresh. The surrounding country often becomes exceedingly dry, and many species of insects congregate in these well-watered places on account of the abundant food supply.

The semiaquatic vegetation bordering small pools and streams also often furnishes good collecting places, as indeed do the waters and bottoms of the pools and streams themselves.

Often along the uncultivated borders of cane fields various kinds of weeds and grasses grow, particularly if in low or somewhat moist and shaded situations. Even the cane fields themselves offer somewhat limited opportunity for collecting.

Nor should the Scotland district with its dense tropical vegetation and

its rock ledges and bluffs be omitted; nor Calais and other sandy beaches; nor the cliffs and upland flats near Speightstown—each somewhat different in its aspect from the other, and lending some variety to the scenery as well as to the day's catch.

The Arachnids are extremely well represented on Barbados, and vary in size from spiders with an extent of from four to five inches to the minute *Tetranychus*. The Barbados tarantula, a tailless whip scorpion, is among the most interesting of the group, and is commonly found under the moist bark of decaying trees.

Myriapods are very common. A black Julid with transverse markings of green and averaging from four to four and one-half centimeters in length is most abundant. On one occasion a sort of migratory movement of these Arthropods was observed. Hundreds of them were crossing the dazzling white coral road in moving from one cane field to another, and all seemed to be going in the same direction. A small Polydesmid is very common under rocks along the bases of the terraces.

Scolopendrids are abundant under sticks and stones in damp places and under the dried leaves of sugar cane, with which some of the fields are covered. These Centipedes are known locally as "forty-legs," and the natives have a great fear of them. The popular belief is that a bite from one of them will cause a "fever" in the victim. The specimens are commonly from three to six inches in length, very active and difficult to handle, and it requires considerable dexterity to transfer one safely to the killing bottle without being bitten.

Many years ago the Mongoose (*Herpestes*) was imported into Barbados for the purpose of destroying the rats. It is now fairly common all over the island. While it, no doubt, has been responsible for some diminution in the number of rats the experiment has not been a success, for in addition to its destruction of birds of various kinds, particulariy the Ground doves (*Columbigallina*), the blood-thirsty animal has killed off a great many lizards and centipedes, which are enemies of insects. As a resuit destructive insects have become more abundant on the island since the introduction of this animal, which is now much despised by the natives.

Of the Hexapoda only the more conspicuous will be mentioned here. On account of the scarcity of suitable breeding places the order Odonata is not well represented. The vicinity of Indian and Bird Rivers and the large swamp in the suburbs of Bridgetown offer limited opportunity for larval development. The common pond fly (*Erythrodiplax umbrata*) and the red pond fly (*Tramea abdominalis*) are probably the most abundant. Four or five other representatives of the order occur here also.

The order Orthoptera is represented by a goodly number of species. Earwigs (*Forficula*) are common in rocky places in the vicinity of cane fields, and in leaf sheaths and stems of old canes. Cockroaches are abundant in cane fields and houses; a half dozen species are found on the island. One of the most common, and at the same time conspicuous representatives of the group is the large, yellowish, short-horned grasshopper (*Schistocerca pallens*), which is found commonly on the flats grown up in sour grass. The insect is very difficult to capture on account of its rapid flight and its habit, when closely pursued, of crawling some distance in the short grass before again taking flight, and then

of springing up suddenly in an unexpected quarter and flying off again. Many miles were traversed in pursuit of these elusive insects. Another common Acridiid is *Orphulella balloui*, which also frequents grass lands. Conocephalids and Gryllids are not abundant.

The Hemiptera is the best represented of any of the orders, both in actual abundance and in number of species. Of the aquatic forms the water strider *Gerris marginata* is by far the most abundant, and is found in all the permanent fresh-water streams and ponds of any size. Of the other Heteroptera the family Pentatomidæ is well represented, about twelve species having been collected. The two most common species are the green bug (*Nezara viridula*) and the brown bug, known locally as the "pea chink" (*Edessa meditabunda*). This latter form is one of the most abundant plant feeding Heteroptera on the island. Two other Pentatomids, *Piezodorus guildinii* and *Arvelius albopunctatus* are also worthy of mention, the former being much the commoner of the two. The cotton stainers (*Dysdercus* spp.) have not yet made their appearance on Barbados although they are present in all the other islands of the West Indian group. Of the Homoptera there are several kinds of scale insects; Cicadellids and Membracids are common on vegetation in moist or partly-shaded places; a few Fulgorids are found in the wooded Scotland district.

Beetles are well represented on Barbados, and a number of them are of considerable economic importance. Perhaps the most conspicuous species in this connection is the Scarabæid beetle, locally called the "brown hardback" (*Phytalus smithi*), the larvæ of which injure the roots of sugar cane, citrus trees, palms and bananas. Effort is being made by the Colonial Department of Agriculture to control the pest by offering prizes to schools and schoolmasters for the greatest number of the insects brought in to the entomologist's office. In addition, a "bounty" of 2d. per four hundred is paid. The writer saw in a glass laboratory jar in Mr. Bovell's office 27,200 live specimens of this beetle which had been collected for the bounty offered. In 1916 the collection of adults on one estate amounted to 589,680. A small Hymenopteron, *Tiphia parallela*, is parasitic on the beetle, but the parasite is not sufficiently abundant to hold the pest in check.

A single tiger-beetle (*Cicindela suturalis* var. *hebræa*) is found upon the island, and at only one place, Calais beach, southeast of Bridgetown. A long stretch of sand affords a typical habitat for this beautiful white form.

Of the aquatic beetles the Dytiscidæ are most abundant, though in the larger pools and streams the large black Hydrophilid, *H. ater*, is not uncommon. Among the Coccinellids, in addition to the common spotted ladybird (*M. maculata*) the red ladybird (*Coccinella sanguinea*) is also found, and is even more common than the former. Strangely enough carrion beetles are not found upon Barbados, and but one species of short-winged scavenger beetle was collected. Once, upon coming across the decaying remains of a mongoose the carcass was examined carefully for insects, but the net result was a single fly puparium. Two other beetles should receive special mention on account of their abundance. The fine black Tenebrionid *Hopatrinus gemellatus* is found everywhere under small stones along the bases of the terraces, and the Chrysomelid *Homophœta aequinoctinalis* is abundant on the common weeds and grasses.

Of the weevils the beautiful gray and black striped Curculionid *Diaprepes*

abbreviatus is one of the most common and, at the same time, destructive. The larvæ are very injurious to sugar cane, boring into the cane bases and sometimes completely severing them. This insect is found throughout the West Indies.

Of the Rhopalocera there are not many examples on the island, but among them are two of our well-known forms, the monarch butterfly (*Anosia plexippus*) and the painted lady (*Vanessa cardui*) both of which are fairly common. The three other common species are *Catopsilia eubule*, *Dione vanillæ* and *Junonia geneveva*.

Moths are moderately common, the Sphingids and Noctuids being best represented. Some of these are present in sufficient numbers to cause considerable damage in the larval state. Among these are the tobacco worm (*Protoparce sexta* and *P. cingulata*), while the familiar cotton worm (*Alabama argillacea*), corn ear worm (*Laphygma frugiperda*) and the boll worm (*Heliothis obsoleta*), as well as various species of "cutworms" (*Prodenia* spp., etc.), come in for their share of attention from the plantation owners. Perhaps the most common moth on the island is the pretty Arctiid *Utetheisa ornatrix*, which is particularly abundant on the high grassy flats and in open places in palm groves.

The order Diptera is well represented, and some of its more notorious members are fairly common. Both the filaria mosquito (*Culex fatigans*) and the yellow fever mosquito (*Stegomyia fasciata*) are present, the former being the more abundant. Practically all the houses of the white people and the better class of negroes are furnished with mosquito nets over the beds, although neither the doors nor the windows are screened against these or other insects. Numerous cases of the deformity known as elephantiasis or Barbados leg are to be seen among the natives, who sometimes adopt curious methods in an attempt to hide their affliction from the public.

Since there is a goodly number of brightly coloured flowering trees and plants on Barbados one naturally expects to find a large and varied hymenopterous fauna. However, he is somewhat disappointed, for the paucity of flower-visiting forms is very striking. One of the most conspicuous bees is the large bluish-black carpenter bee (*Xylocopa aeneipennis*), which builds its nest in old posts and decayed branches of trees. A still larger and reddish-brown form (*Xylocopa fimbriata*) is also quite common. Both are excellent flyers for such heavy bodied insects. Of course, the honey bee (*Apis mellifera*) is also found in some numbers, although it is not so common as with us. Of the wasps (Vespidæ) the "Jack spaniard" (*Polistes annularis*) is very common and builds its paper nests on the sides of the rocky terraces. The cow bee (*Polistes bellicosus*, is found less commonly but in similar situations. The family Formicidæ is represented by considerably the largest number of species.

Aside from the strictly entomological aspect and from the facts already mentioned, two or three items of particular interest stand out in the writer's mind as worthy of special note. Seldom is it that a tropical country is entirely free from snakes but, so far as is known, none now occur on the island of Barbados and but one small worm-like form (*Typhlops* sp.) has been able to survive the mongoose and other enemies on Antigua. Lizards are, however, extremely abundant on the trees and among the rocks and, of course, form an important natural check to the increase of noxious insects.

As the collector proceeds along his hot and dusty way he suddenly comes upon one of the dazzling white coral roads. Following this for a short distance a large iron hydrant comes into view, and soon refreshing water is to be had. These hydrants, similar in size and shape to the fire hydrants in our cities, are found along the main highways at intervals of from a mile to two miles, and are practically the only means the natives have of obtaining water which is stored in reservoirs far inland and piped to all portions of the island, except the rough Scotland district. Quite a different situation prevails in Antigua, where practically all the drinking water is collected in great catch basins and the natives in the rural districts must carry it to their homes, sometimes a considerable distance away.

(To be continued.)

THE IMMATURE STAGES OF THE GOLDENROD LEAF-BUG, *STRONGYLOCORIS STYGICA* SAY (MIRIDÆ, HETEROP).

BY MORTIMER D. LEONARD, ITHACA, N.Y.

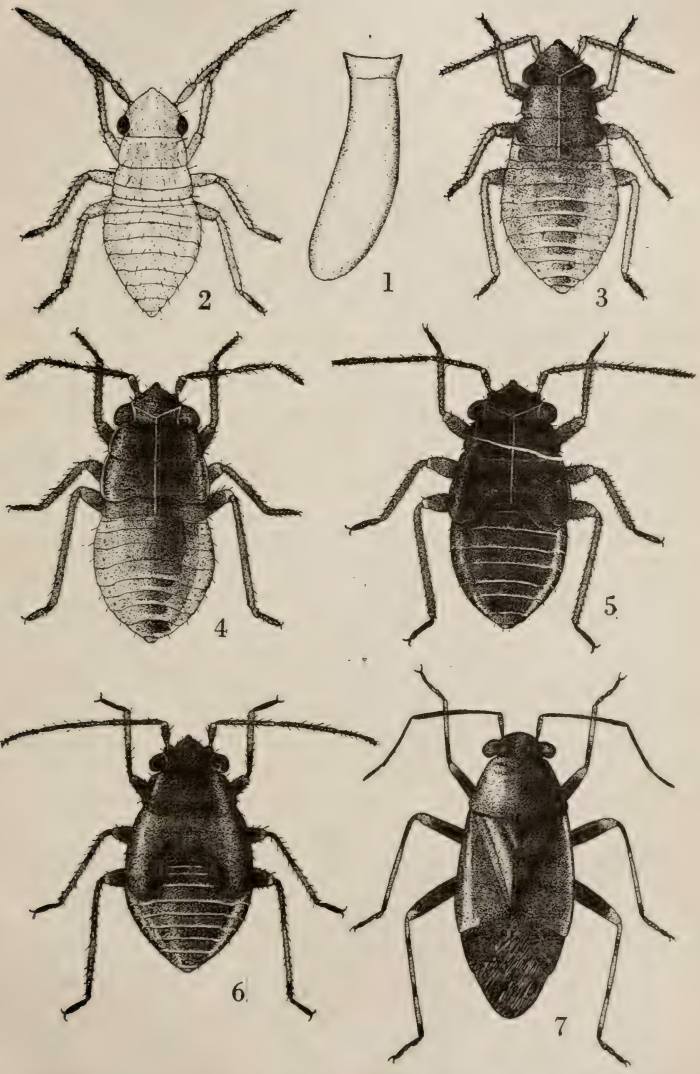
During the latter part of May and the first of June, in the vicinity of Honeoye Falls, N.Y., the nymphs of a black leaf-bug are found in great abundance in patches of goldenrod, where they subsist on the leaves of this plant. Little is known concerning the life-history or the seasonal history of this insect. In 1916 on June 5, nymphs of all stages were found in a large patch of goldenrod. Those of the second stage, however, predominated, and only a few individuals in the fourth and fifth stages were present. Second and third stage nymphs were noticed as early as June 1, feeding on the tender leaves of the terminal shoots. By July 5, fifth stage nymphs predominated.

Following is a description of the several stages which the insect passes through in the course of its development. To Mr. H. H. Knight I am indebted for the determination of the species. The drawings were made from living material by the writer.

Egg (Fig. 1). The eggs of this species have not been found, but they are undoubtedly inserted into the more succulent portions of the goldenrod stems during late June and July, where they remain over winter and hatch the following May. On June 25, 1915, females, apparently swollen with eggs, were common. On opening the abdomen of some of these eggs, which were undoubtedly mature, were found. The description of such an egg is as follows: length 1 mm.; greatest width .27 mm.; pale yellowish or translucent, shining, cylindrical and slightly curved; somewhat compressed, and with a prominent cap which is narrowly elliptical when viewed from the top.

Stage I (Fig. 2). Length .93–.97 mm.; width of head including eyes .33 mm. General colour yellowish; head and thorax slightly tinged with orange or pale brownish; each of the thoracic segments with a pair of darker spots. These spots are usually faint, but vary somewhat in intensity with the individual and as to whether it is newly hatched or nearly ready to molt. Eyes reddish. Antennæ tinged with dusky; tip of first three segments often somewhat paler. Tarsi tinged with dusky. Caudal border of meso- and metathorax slightly curved backward.

Stage II (Fig. 3). Length 1.3 mm., greatest width (across abdomen) .6 mm. Head and prothorax blackish; the hind angles of the mesothorax and



STRONGYLOCORIS STYGICA SAY (MIRIDÆ, HETEROP).

the lateral border of the metathorax yellowish brown; a brownish yellow median line on the thorax meets a V-shaped line of the same colour on the head between the eyes. Abdomen yellowish brown with a series of darker median transverse spots in the centre of each segment, becoming successively smaller toward the caudal end; abdominal spiracles indicated by a series of small dark dots. Eyes dark reddish. Antennæ brownish yellow, tip of first three segments somewhat lighter. Legs concolorous with antennæ; femora, except tip, and tarsi darker. Caudal margin of meso- and metathorax either straight or curved slightly forward.

Stage III (Fig. 4). Length 1.6 mm., greatest width (across mesothorax) .7 mm. Head and thorax shining black; inner margin of eyes narrowly yellowish; a narrow, yellowish median line on thorax, which, as in the preceding stage meets a V-shaped line of the same colour on the head between the eyes. In the darker specimens this is sometimes but faintly indicated on the thorax. Abdomen dark reddish, marked as in preceding stage, except that in the darker specimens the median spots entirely overlie the ground colour. Eyes dark reddish. Antennæ pale brownish; tip of first three segments lighter. Legs dark brownish or dusky; tip of femora lighter; tarsi somewhat darker. Wing-pads becoming apparent.

Stage IV (Fig. 5). Length 1.8 mm., greatest width (across wing-pads) about 1 mm. Head and thorax black, somewhat shining and finely punctate. The narrow median line on thorax and V-shaped line on head in this stage are reddish. Inner border of eyes narrowly reddish. Abdomen very dark reddish brown; posterior border of segments narrowly reddish. Eyes blackish. Antennæ grayish brown; extreme tip of first two segments lighter. Legs concolorous with antennæ; extreme tip of tibiæ lighter; tarsi darker; coxæ and trochanters pale translucent yellowish. Wing-pads reach nearly to fourth abdominal segment. Venter reddish brown. Beak brownish yellow; tip and base blackish.

Stage V (Fig. 6). Length 3.1 mm., greatest width (across wing-pads) 1.8 mm. Much the same as the preceding stage. There is, however, no median line on the thorax or V-shaped line on the head, and the antennæ are somewhat darker than in the preceding stage. The femora, except the tip, and the basal half and tip of the tibiæ are dark brownish. The wing-pads now reach nearly to the fifth abdominal segment.

Adult Fig. 7). Length 5 mm. Shining black; membrane dark brownish. Eyes dark brown. Leg markings somewhat variable but in general femora are blackish, tip brownish yellow; base and usually tip of tibiæ blackish; sometimes only base of front tibiæ black, and more or less all of middle and hind tibiæ black. Tarsi often entirely blackish, or with two basal segments somewhat paler. Beak more or less brownish. Venter shining black, nonpunctate, and in certain lights finely clothed with short golden hairs. With the exception of the genetalia there is no apparent difference in the sexes.

EXPLANATION OF PLATE XIV.

Fig. 1. Egg.
Fig. 2. First stage nymph.
Fig. 3. Second stage nymph.
Fig. 4. Third stage nymph.
Fig. 5. Fourth stage nymph.
Fig. 6. Fifth stage nymph.
Fig. 7. Adult.

NOTES ON THYSANOPTERA FROM BRITISH COLUMBIA.

BY R. C. TREHERNE, FIELD OFFICER, ENTOMOLOGICAL BRANCH DOMINION DEPARTMENT OF AGRICULTURE.

The following notes are submitted herewith to augment our knowledge of Western Thysanoptera, a group which appears to have been sadly neglected by Canadian entomologists.

Orothrips kelloggii yosemitii Moulton. (Plate XV, Figs. 1–3.)

A single female of this variety was taken on Mt. McLean at Lillooet, B.C., at an altitude of about 6,000 feet, off *Amelanchier*, on July 25, 1917. I have been unable to compare this single female with specimens of *kelloggii* or of its variety *yosemitii*. From the description, however, given by Moulton (1), the the shape of the sense areas on antennal segments 3 and 4, together with the relative lengths and colours of the antennal joints, clearly place the specimen from Lillooet as belonging to the variety *yosemitii*. There are, however, certain structural features in the specimen before me which differ from the short description given by Moulton.

Antennæ.—The measurements of the antennal segments compare with the description with the exception of segment 4, which compares with segment 3 in length as 74 to 99μ, instead of as 96 to 99μ. The constriction in segment 3 is not very apparent, and the base of segment 3 is white or at least lighter in colour than the apical portion of segment 2, which is yellow. Sense areas are present on the apical portions of segments 3, 4, 5 and 6; those on segments 3 and 4 ovoid; those on segments 5 and 6 circular, with a simple transparent sense-cone protruding from each. There also appear to be two ovoid sense areas, beside each other, on segment 3, and the same on segment 4.

Mouth Cone.—Maxillary palpi 7-segmented, the basal joint large and as long as the remaining six segments; labial palpi 4-segmented.(2)*

Colour.—The colour is brown; head and prothorax darker than the remainder of the body, which is shaded with orange.

It may be seen, therefore, that despite the small variations noted, the species from Lillooet belongs to the variety *yosemitii*. Being so, it is interesting, as this record greatly extends the distribution of this insect, which so far has only been recorded from the Yosemite Valley, California.

Æolothrips fasciatus Linn. (Plate XV, fig. 4.)

I find in my collection two male specimens of this species; one taken off *Lithospermum pilosum* from Kelowna, B.C., on May 16, 1917; and the other off the bloom of the cultivated dahlia from Agassiz, B.C., on July 14, 1914. The latter specimen was taken in association with females of the same species and with many adults of *Frankliniella tritici*. In the literature at my disposal I have been unable to find any reference to males of *Æ. fasciatus*. For that reason I submit herewith the following description with the respective measurements of the two specimens before me.

Æ, fasciatus, 2 males (A and B).

Head, length .14 mm. and .14 mm., width .17 mm. and .18 mm.; prothorax, length .15 mm. and .15 mm., width across centre .18 mm. and .20 mm.; meso-

*Moulton (2) gives labial palpi 4—segmented in the key, but on pp. 45-46 gives 5—segmented in the description of the genus and species.

and metathorax length over dorsal plates .26 mm. and .22 mm., width across metathorax .28 mm. and .26 mm.; abdomen, length .84 mm. and .82 mm., width across male appendage on 9th segment .21 mm. and .21 mm.; total length of body 1.39 mm. and 1.33 mm.; antennal length .46 mm. and .37 mm.; length of segments:

	1	2	3	4	5	6–9
A	35	52	113	105	87	70
B	32	43	78	87	70	61

Colour, uniformly light brown, first few abdominal segments slightly lighter in colour, though blending with remainder of body; male appendage of same colour as the head, intersegmental and body pigment carmine. Antennal joint 1, concolorous with head; 2 brown shading to light brown at tip; 3 light brown at base, brown in upper half with a circle of darker brown at tip; remaining segments 4–9 brown. Legs brown concolorous with head with the exception of upper half of fore-tibiæ and fore-tarsi, which are light brown. Fore-wings banded with two brown between three white areas.

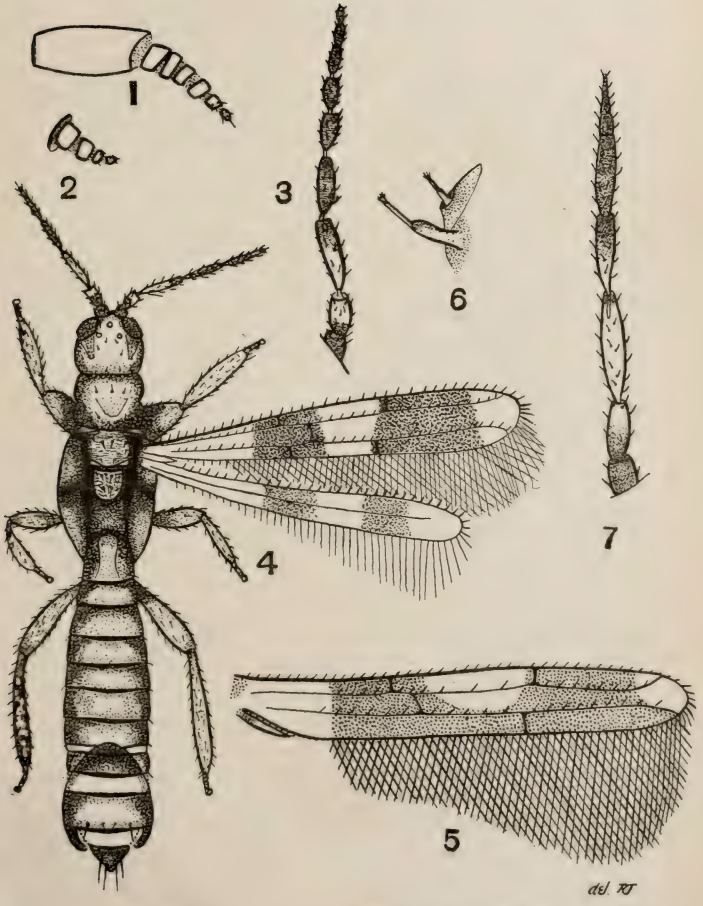
Females have been taken on a variety of plants of which may be mentioned *Elymus condensatus*, clover, *cratægus*, cherry, *Prunus demissa* and *Amelanchier* at various times during May, June and July 1914–1918 at Victoria, Lillooet, Agassiz, Vernon and Kelowna. The distribution of this species in the Province of British Columbia must, therefore, be widespread, inasmuch as it has been taken in localities varying from the humid to the arid. During the summer of 1918 females of this species were observed to be in association with the Onion Thrips (*T. tabaci*, upon which it is doubtless predacious, on onion foliage at Kelowna, B.C. Williams (3) records this species as predacious on the pea thrips (*Kakothrips pisivora* West) in Europe, but also notes that it feeds on pollen and plant juices (4).

Æolothrips annectans Hood (5).

(Plates XV, fig. 5, and Plate XVI, fig. 1.)

This species apparently occurs commonly in British Columbia. It has been taken on several occasions during May, June and July in the past three years at points in the Okanagan Valley, and in the vicinity of Victoria on Vancouver Island. It has been taken also on a variety of plants, among which may be mentioned, *Acer glabrum*, *Ribes viscosissimum*, *Sambucus racemosa*, *Ilex europæus*, apple, alder, *Lithospermum pilosum*, *Amelanchier florida*, and in sweeping through general vegetation. Possibly the most notable record of its presence in numbers was observed in Kelowna, B.C., during early July (1918) in commercial onion plantations, where many specimens were seen associated with and doubtless predacious upon the onion thrips (*T. tabaci*). Mr. J. D. Hood, to whom some British Columbia specimens were submitted, agreed that my "determination was correct, though a remarkable addition to its known distribution," (April, 1918). According to my information this species thus far has only been recorded from Maryland, Virginia and New York State, U. S. A. (6).

Eleven specimens before me clearly agree with the account given by Hood (5). The presence of slight transverse striations across the occiput constitutes



BRITISH COLUMBIA THYSANOPTERA.

the only main difference from the published description. The fore-wings are shaded as described, but in addition have their extreme basal portions, (scale and fore-wing), shaded brown-gray. The measurements of the British Columbia specimens may be briefly given as follows:

Head, length .15 mm., width across occiput .19 mm.; prothorax, length .15 mm., width at centre .22 mm.; total length of body, 1.7 mm–1.8 mm.; fore-wing, length .94 mm.–1.01 mm.; antennæ, length .40 mm.–.42 mm.; antennal segments, length:

Segment	1	2	3	4	5	6–9
Length	30	52	105–122	87–96	70	52

In addition, the following notes are added to the description already given by Hood:

Fore-wings.—Cross-veins present; two cross-veins connecting anterior ring vein to first longitudinal vein, one connecting the two longitudinal veins, one and (apparently) sometimes two connecting second longitudinal vein to posterior margin of wing; spines on anterior margin of ring vein 37–41, on first or anterior longitudinal vein 13–16 (arranged 6–8 brown, 2–3 white, 4–6 brown), on second or posterior longitudinal vein 19–21 (arranged 1 white, 18–20 brown); on scale 5–6 on anterior margin and one central. The two wings of the same specimen often vary in the matter of alar spines.

Maxillary palpi.—3-segmented, geniculate, basal joint twice as broad and nearly twice as long as the middle joint, apical small; labial palpi 4-segmented, basal joint as long as the remainder.

Æolothrips auricestus, new species.

(Plate XV, figs. 6, 7, and plate XVI, fig. 2.)

I am indebted to Mr. J. D. Hood, of the United States Biological Survey, for confirming my belief, that this species has not been previously described.

Measurements.—Head, length .18 mm., width across occiput .21 mm.; prothorax, length .18 mm., width .22 mm.; mesothorax, length .24 mm., width .35 mm.; abdomen, length 1.48 mm. Total length of body about 2.08 mm.; antennæ, total length .44 mm.; antennal lengths:

Segment	1	2	3	4	5	6–9
Length	35	61	113–122	87–91	70	70

Colour.—Brown; head slightly darker brown than other parts of the body; antennal segment 1, brown; 2, brown at base (at times light brown at base) shading to white at tip; 3, creamy-white with a circle of brown at tip; 4, pale-brown at base shading to brown at tip; remaining segments similar to segment 1. Legs brown, fore-legs lighter; fore-tibiæ and tarsi light-brown; abdomen segments 2–6 golden-yellow, last four segments brown, segment 1 light brown shading to yellow on posterior half. Fore-wings banded, with two brown areas between three clear white ones, each area of about equal width. Hind wings banded, similar to the fore-wings, but the bands of brown are pale and indistinct. Scale shaded brown at base.

Head.—Slightly wider than long, about equal in length to the prothorax, slight transverse striations across occiput, covered with numerous small spines;

1 2

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eyes large, on ventral surface extending rather more than half way the length of the head, coarsely faceted and sparsely pilose; ocelli three, conspicuous, the posterior pair contiguous with the inner margins of the eyes; mouth-cone reaching into the posterior third of the prothorax; maxillary palpi 3-segmented, geniculate, basal joint twice as broad and nearly equal in length to the middle joint, apical small; labial palpi 4-segmented, three apical joints slightly longer than basal joint; antennæ 9-segmented, about two and one-half times as long as the head, all segments clothed with numerous short spines, those on segments 1 and 2 fewer and stouter, spines on all segments about equal in colour to the segments upon which they are placed; sense areas on apical portions of segments 3, 4 and 5, being respectively elongated and inconspicuous, elongated and conspicuous, oval and conspicuous.

Prothorax.—Slightly wider than long, about equal in width and length to the head, emarginate midway on each lateral margin, the dorsal surface clothed with numerous stout spines. *Mesothorax* wider than prothorax, mesoscutum striate-reticulate, with eight prominent spines. *Metathorax* narrower than mesothorax, metascutum reticulate, with four spines on dorsal surface. *Legs*, front femora thickened, slightly lighter in colour to femora of middle and hind legs, all tibiæ armed at apex, those spines on hind tibiæ much the strongest, hind tibiæ with 8–10 stout spines on inner margin, each fore-tarsus armed with a stout hook, which is yellow, and a tooth, which is shaded brown. *Fore-wings* reaching to about the eighth abdominal segment, rounded at tip, cross-veins present, no cross-vein apparent connecting the second longitudinal vein with the posterior ring vein, five to eight minute spines on each brown area on the anterior longitudinal vein, and six to eight on each brown area on the posterior longitudinal vein, right wing often varying from the left wing in the matter of alar spines, all spines equal in colour to the portion of wing upon which they are placed; scale with one central spine and six to eight inconspicuous spines on anterior margin. *Hind wings* with a short spine-like fringe on anterior margin reaching from basal fourth to tip, simple fringe along the posterior margin. *Abdomen* elongate-ovate, conspicuous spines only on the ultimate and penultimate sgments.

Described from 9 macropterous females, taken by the author from the Western Wild Rye grass, *Elymus condensatus*, at Vernon and Kelowna, British Columbia, in July, 1917. Brachypterous forms also occur in association with the macropterous forms. Their body characters agree with the above account.

The type and cotype have been placed in the collection of the National Collection of Insects, Department of Agriculture, Ottawa, Canada. Paratypes are also retained in the collection of the author.

Taeniothrips inconsequens Uzel. (The Pear Thrips.) Plate XVII.

During the course of a two-year's study (1916, 1917) of the pear thrips, *Taeniothrips* (*pyri* Dan) *inconsequens* Uzel, on the Pacific coast of British Columbia, a number of variable points in the external anatomy became apparent following the close examination of a large number of specimens. Early in the study it was apparent that the spines upon the wing, both as regards numbers and position, represented too variable a character alone to certify its specific identity. This observation led to a close examination of the essential specific

characters of the species, and the results of this study are recorded herewith, supplementing the description already given by Moulton (2).

Head.—Width across the occiput .15 mm., across the eyes .13 mm.; length 3. mm.; slightly wider than long; cheeks arched; occupit transversely striate, bearing eight minute spines immediately posterior to the compound eyes; a pair of very prominent spines between the posterior ocelli, situated within the margins of the pigmented ocellar crescents; a single minute spine, on each side, near the margin of the compound eyes, in a lateral direction from the anterior ocellus; vertex smooth; compound eyes, prominent, oval in outline black with light borders, coarsely faceted and slightly pilose; ocelli approximate yellow, margined inwardly with orange-brown crescents, posterior ones approximate to but not contiguous with the light inner borders of the eyes. Mouth-cone pointed, tipped with black, maxillary palpi three-segmented, each segment about equal in length, the second shortest and the third longest; labial palpi two-segmented, basal segment very short. Antennæ eight-segmented, about two and one-half times the length of head (.32 mm.); spines on all segments pale; a forked sense area on dorsal surface of segment 3, with a similar area on ventral surface of segment 4, with a pair of moderately stout spines immediately beneath each area; whorls of minute inconspicuous hairs on posterior portions of segments 3 to 6. Antennal lengths, segment 1, 33μ to 36μ; 2, 42μ to 47μ; 3, 63μ to 64μ; 4, 54μ to 64μ; 5, 33μ to 42μ; 6, 57μ to 66μ; 7, 9μ to 10μ; 8, 12μ to 13μ. Total length .30 mm. to .34 mm.

The head characters, thus given, are apparently stable, and represent the typical formation. Three prominent spines of equal and normal length may, however, at times, be found between the posterior ocelli. Variations in the antennæ are frequently met with, but these may be classed as distinct deformities. They often take the form of a reduction in the number of segments from eight to seven or six, either by the fusion of two segments or by the complete elimination of certain segments.

Prothorax, length .13 mm.; breadth .2 to .25 mm.; as long as head, but wider; dorsal surface smooth; sides slightly arched; a weak spine anteriorly-directed on the anterior angles; a pair of large, strong spines on the posterior angles; from twenty-eight to thirty-six spines scattered over the dorsal surface, all small and inconspicuous, except a central moderately stout pair on the posterior margin and a single one, of equal strength, on each side, situated immediately cephalad of the stout pair in the posterior angles. *Mesothorax*, sides evenly convex, angles rounded; scutum (mesonotal plate) striate. *Metathorax*, scutum and scutellum (metanotal plates) faintly striate; four spines along anterior margin of scutum, the inner two the largest. *Legs* moderately long; spines on tip of fore and middle tibiæ weak; hind tibiæ furnished with a row of seven to nine strong, light-brown spines and a pair of stout spines borne at the tip of each tibia; tarsus furnished with one comparatively stout light-brown spine near the base, and a few pale ones. *Wings* present, extending slightly beyond the tip of abdomen, about twelve times as long (1 mm.) as wide; pointed at tips; colour very slightly tinted light-brown; costal vein thickly set with from twenty-three to thirty-three long spines; costal fringe twice as long as costal spines; fore-vein with twelve to twenty-two spines arranged in groups. On the basal half of wing, on the fore-vein, a single small spine, followed by a

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group of three spines, followed by a variable group of not less than four and as many as eight spines; on the distal half of wing the spines of the fore-vein are exceedingly variable, both as regards numbers and disposition; hind-vein with twelve to eighteen regularly placed spines; scale five spines; interior of scale one spine.

It may be shown, also, that it is the exception, not the rule, to find the two wings of the same specimen equal as regards length of wing, or number and disposition of alar spines. Almost invariably the two wings are dissimilar in some respect. Plate XVII represents outline camera lucida sketches of the right and left wings of ten typical specimens. Rather more than half of the wings examined (59 per cent.) showed the basal portion of the fore-vein with spines "arranged in two groups of 3 to 6, respectively," whilst 28 per cent. were arranged in two groups of 3 and 5, 7 per cent. in 3 and 7, 5 per cent. in 3 and 4, and 1 per cent. in 3 and 8. These figures, indicating the differences that are liable to occur plainly, show that the wing characters are of minor value in the quick and ready examination for the determination of the species.

Abdomen sub-ovate; 10-segmented, tapering abruptly toward the tip from the eighth segment. Dorsal surface of segment 2 to 8 with from eight to ten spines on each segment, the most prominent being on the lateral margins; posterior margin of segment 8 with a fine comb-like structure consisting of from thirty-eight to forty-four teeth; segments 9 and 10 with about ten of the longest and most prominent spines of the body. *Total length* from tip of vertex to tip of abdomen about 1.26 mm. *Colour*, head, thorax and abdomen uniformly dark-brown with connective tissue between segments of the abdomen, the tarsi and tibiæ shading from light-brown to yellow. Segment 3 of the antennæ light brown.

The wings though slightly tinted with light-brown, when resting over the back, appear, to the naked eye, to be grey in comparison to the dark-brown of the abdomen. Many light coloured specimens, especially those forms which have recently emerged from the soil in the spring, may be frequently observed; this colour difference, however, may be preserved throughout the life of the adult.

Thrips physapus Linn.

This species is common in British Columbia, under arid and humid conditions, and may be found throughout the entire season. It has been taken commonly off dandelion at Vernon and near Victoria during early April and May, as well as off *Rubus parviflorus* flowers during June in Vancouver, and recently it has been found in the blooms of partly frozen garden flowers, during December. Carpenter (7) before the Royal Dublin Society in 1900 and again in 1901, draws attention to this species as being destructive to the blossoms of the pear near Dublin, Ireland, causing a failure in the fruit crop. In British Columbia, in localities frequented by *Taeniothrips inconsequens*, *Thrips physapus* also is found to occur, often in similar positions on like plants, frequently associated in the same blossom.

Thrips tabaci Lind.

The adults of this species are known as the "Onion thrips" in British Columbia. The species undoubtedly occurs on a wide range of plants, and is

known to cause considerable commercial loss in onion plantations in the "dry belt" of the Province. First generation larvæ developing from eggs laid by overwintering specimens become first apparent in early June in the Okanagan Valley. This species also occurs on Vancouver Island.

Haplothrips statices Hal.

This species has been beaten from the branches and foliage of cultivated apple and plum trees, *Spiræa discolor*, and other native shrubs at Victoria on Vancouver Island and at Vernon, B.C. It appears to be the commonest species infesting the flower heads of clover, having been observed in great numbers in such plants, both at Vernon and Penticton, B.C. This insect has been recorded from many widely separated points, including, on the west, Oregon and California (8). From Montana (9) we receive information that this species has been proven destruction to the set of red-clover seed. Judging from the numbers that this species occurs in the clover heads, particularly in the "dry belts" of the Province of British Columbia, it is possible that some injury, not as yet proven, may be caused.

Leptothrips mali Fitch.

I am indebted to Mr. J. D. Hood for establishing the correct identity of both a nymph and an adult of this species. With this assistance I am able to offer the following few additional notes on the habits of the species:

A colony of twelve adults was taken clustering in the empty burrow of some solitary burrowing hymenopteran in a dead twig of an Olivet cherry tree at Okanagan Falls, B.C., on April 10, 1918. It was evident that these insects, which were a few inches from the entrance of the burrow, had hibernated in this position. They were observed first on splitting the twig lengthwise.

On August 27, 1917, a group of 5 nymphs and 2 females of this species were taken off the gummy exudation caused by the larva of *Anarsia lineatella* on a peach tree at Penticton, B.C. They were apparently feeding on the exudate. Specimens of individual adults have been taken at various times during May, July and July off the foliage and branches of *Acer glabrum*, alder, amelanchier, apple, peach and cratægus, at points in the Okanagan Valley between Vernon and Vaseaux Lake, Lillocet, and near Victoria on Vancouver Island.

As recorded by Hood (8) this species is widespread in its distribution and common "from early spring to late fall." He states that for the most part this species lives "singly on the leaves of various trees." This agrees entirely with the majority of the records noted above. It is only necessary to add that, apparently, adults cluster for hibernation purposes, and that nymphs may, at times, be found closely assembled at one place.

Chirothrips manicatus Hal.

Males and females of this species occur commonly at the Coast, and in the Interior of British Columbia on many roadside grasses.

I wish in conclusion to thank Mr. J. D. Hood, of the United States Biological Survey, for the assistance he has given me in this group of insects. Furthermore, my thanks are due to Mr. Warburton Young, of the Health of Animals Branch, Dominion Experimental Farm, Agassiz, B.C., for his drawings of *Æ. auricestus* and *Æ. annectans*.

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EXPLANATION OF PLATES.

PLATE XV.

Fig. 1. *Orothrips kelloggii yosemitii*, maxillary palpi.
Fig. 2. *Orothrips kelloggii yosemitii*, labial palpi.
Fig. 3. *Orothrips kelloggii yosemitii*, right antenna.
Fig. 4. *Æolothrips fasciatus*, male.
Fig. 5. *Æolothrips annectans*, right wing.
Fig. 6. *Æolothrips auricestus*, n. sp., maxillary and labial palpi.
Fig. 7. *Æolothrips auricestus*, n. sp., left antenna.

PLATE XVI.

1. Brachypterous female of *Æolothrips auricestus*, n. sp. (drawn and painted under author's instruction, by Mr. C. W. Young, Agassiz, B.C.).

2. Macropterous female of *Æolothrips annectans* Hood, (drawn and painted under author's instruction, by Mr. C. W. Young, Agassiz, B.C.).

PLATE XVII.

Variations in alar armature of fore-wing of *Tæniothrips inconsequens* (diagrammatic, author's illustration).

APPOINTMENTS—CANADIAN ENTOMOLOGICAL BRANCH.

Mr. Leonard S. McLaine, M.Sc., of the Canadian Entomological Branch, has been transferred from the Dominion Entomological Laboratory, Fredericton, N.B., to Ottawa, and has been appointed Chief of the Division of Plant Inspection and Executive Assistant to the Dominion Entomologist. As Chief of the Division of Plant Inspection, Mr. McLaine will have immediate charge of the work of inspection and fumigating imported nursery stock, and of the field work against the Brown-tail Moth in Eastern Canada, and such other duties as the enforcement of the insects and pests regulations under the Destructive Insect and Pest Act may involve.

Mr. M. B. Dunn, Temporary Assistant at the Dominion Entomological Laboratory at Fredericton, N.B., has been appointed an Entomological Assistant in the Division of Forest Insects of the Entomological Branch, Ottawa, and under the direction of Dr. J. M. Swaine he will be assigned to sample plot investigations in the forests of Quebec and Ontario.

NEW NEARCTIC CRANE-FLIES (TIPULIDÆ, DIPTERA) PART VIII.

BY CHARLES P. ALEXANDER, URBANA, ILL.

As in the other papers of this series, the types of the new species are deposited in the collection of the writer, unless stated otherwise.

GENUS *Dicranoptycha* OSTEN SACKEN.

Dicranoptycha sobrina quadrivittata, new subspecies.

Female.—Length 10 mm.; wing 10.5 mm.

This variety is similar to typical *sobrina*, differing as follows:

Mesonotal præscutum gray, more yellowish on the disk, clearer gray along the margin; four distinct dark brown stripes, the median pair longest, indistinct in front, clearer behind, lying parallel and separated from one another only by a capillary gray line. Tuberculate pits distinct, close together, lying just before the level of the pseudosutural foveæ, separated from one another by a distance a little less than the diameter of one. Pseudosutural foveæ very pale, elongate, linear. Lateral stripes short. Scutal lobes dark brown. Pleura grayish above, paler ventrally. Coxæ whitish. Wings gray; veins dark brown; wings very long and narrow; *Rs* shorter than cell *1st M*$_2$, almost square at its origin and running close to *Ri*; *Sc* ends just before the fork of the sector. Abdominal tergites uniformly dark brown.

Habitat.—Colorado.

Holotype.—♀, Peaceful Valley, Colorado, August 25, 1917, (T. D. A. Cockerell).

This species was included in some interesting crane-fly material kindly sent me for study by Prof. Cockerell. It is very different in the details given above from the extensive series of typical *sobrina* in my collection. More material will be needed to determine the true status of the fly.

GENUS *Molophilus* CURTIS.

Molophilus squamosus, new species.

Antennæ of the male short; general coloration dark gray; male hypopygium with the dorsal pleural appendage flattened, very broad, the dorsal face roughened; ventral pleural appendage a powerful black arm that is acute at the tip, which is bent ventrad.

Male.—Length 3.2–3.4 mm.; wing 4.7–5 mm.

Rostrum and palpi dark brown. Antennæ of the male short, dark brown throughout. Head gray.

Pronotum dark brown medially, yellowish laterally. Mesonotum gray, the humeral angles paler; scutelum yellowish; postnotum brownish gray. Pleura grayish. Halteres yellow, the knobs a little darker. Legs with the coxæ, trochanters and base of the femora yellowish; remainder of the legs brown. Wings whitish subhyaline; veins dark brown; a very indistinct darker clouding along the cord at *r*, *r-m* and the basal deflection of *Cu*$_1$. Venation: deflection of *R*$_{2+3}$ short, subperpendicular, shorter than the basal deflection of *Cu*$_1$; fusion of *Cu*$_1$ and *M*$_3$ very long, much longer than *Cu*$_1$ beyond the fork.

Abdomen dark brown, the posterior margins of the tergites yellowish, broader on the terminal segments; hypopygium grayish brown. Male hypopygium with each half of the tergite contiguous or overlapping at the tips. Dorsal pleural appendage lying transversely, the tip directed proximad and dorsad,

very broad and flattened with the dorsal surface minutely roughened into tiny spines or raised scales that are more prominent, subserrate, along the outer margin. Ventral pleural appendage powerful, acute, shiny black, straight basally, suddenly narrowed to the acute tips which are directed ventrad, the concave face weakly toothed.

Habitat.—California.

Holotype.—♂, Alpine, San Diego County, California, April 9, 1915, (M. C. Van Duzee).

Paratopotype.—Sex uncertain.

The type is in the collection of Mr. Van Duzee.

Additional specimens of a closely related form from the Muir woods, Marin County, California (May 19, 1915, M. C. Van Duzee) agree closely with this species in general characters, but are much more reddish in their general colour, the dorsal pleural appendage not so broad, and the ventral pleural appendage with about three or four large spinules before the tip. *Molophilus squamosus* is a small, delicate species, allied to *M. paulus* Bergroth, but readily distinguished by the very broad, dorsal pleural appendages and the differently constructed ventral appendage. From *M. spiculatus* Alex., *M. comatus* (Doane) and other allied forms it is told by its much smaller size and slightly different structure of the male hypopygium.

Molophilus bispinosus, new species.

Antennæ of the male short; general coloration light brown; male hypopygium with the lobes of the ninth tergite produced apically into straight, slender arms; dorsal pleural appendage elongate, very straight and slender, acute at the tip; ventral pleural appendage powerful, sickle-shaped, the concave face with strong spinules.

Male.—Length about 4 mm.; wing 5.5 mm.

Rostrum and palpi brown. Antennæ of the male short, the scape brownish yellow, the flagellar segments dark brown, clothed with a long pale pubescence. Head with the front yellow, vertex and occiput gray.

Pronotum pale. Mesonotum light brown, the tuberculate pits black, widely separated. Pleura grayish brown. Halteres pale. Legs brownish yellow, the tips of the tarsi darkened. Wings subhyaline; a faint blotch of dark hairs on the radial cross-vein and another on the radial-median vein; a faint cloud at the basal deflection of Cu_1; veins dark brown, subcosta yellow. Venation: basal deflection of R_{4+5} and *r-m* in alignment; fusion of Cu_1 and M_3 a little shorter than Cu_1 beyond the fork.

Abdomen dark brown, the hypopygium reddish yellow. Male hypopygium with the tergite profoundly split medially as in the genus, the halves thus formed with the tips rather narrow, directed proximad so as to be almost contiguous on the median line; each lobe on the sides at the apex produced caudad into a slender, flattened, straight, fleshy lobe whose inner margin is fimbriate. Dorsal pleural appendage slender, elongate, almost straight beyond the enlarged base, the tips acute. Ventral pleural appendage powerful, strongly curved, the subacute apex directed ventrad, the ventral or concave face with several equidistant large and acute spinules.

Habitat.—California.

Holotype.—♂, Berkeley, California, May 25, 1915, (M. C. Van Duzee).

GENUS *Gnophomyia* OSTEN SACKEN.

Gnophomyia tristissima cockerelli, new subspecies.

Female.—Length about 8.5 mm.; wing 7.2 mm.

Similar to typical *tristissima*, differing as follows: Antennæ a little longer. Legs somewhat stouter. Wings hyaline, with a few dark seams along the veins, these seams on *Rs*, R_{4+5}, *M*, *Cu*, M_3 and *second A;* cell *Sc* dark. Venation: *Sc* ending beyond the fork of *Rs; Sc*1 long, about equal to R_{2+3}.

Habitat.—Colorado.

Holotype.—♀, Campus of the University of Colorado, Boulder, Colorado, September 20, 1917, (Felicita Claer).

The distinctly bicolorous, longitudinally streaked, wings is the most conspicuous character to separate this fly from typical *tristissima* O. S. of the eastern United States, in which the wings are uniformly darkened. The type was kindly sent me by Prof. Cockerell, to whom the form is respectfully dedicated. In the collection of the United States National Museum there are a few specimens of this variety, likewise from Colorado (from the collection of C. V. Riley, taken by Morrison).

GENUS *Gonomyia* MEIGEN.

Gonomyia (Gonomyia) aciculifera, new species.

Belongs to the *noveboracensis* group; similar to *noveboracensis* Alex. but larger; wings with *Sc* shorter and with *Sc*2 at the tip of *Sc*1; R_2 not so close to R_1 at the wing margin; male hypopygium with the ventral pleural appendage expanded at the apex into a paddle-like blade whose lower margin is minutely toothed.

Male.—Length 5 mm.; wing 5.4 mm.

Described from an alcoholic specimen.

Rostrum and palpi entirely dark brown. Antennæ dark brown throughout, the basal segments enlarged. Head dark.

Mesonotum dark, the humeral angles a little brighter. Pleura brownish, brighter posteriorly. Halteres elongated, pale, the knobs dark. Legs with the coxæ dark, the trochanters a little paler; remainder of the legs broken. Wings pale grayish yellow; stigma indistinct; veins light brown. Venation: *Sc* rather short, ending far before the origin of the sector, the distance between the two only a little less than the length of the basal deflection of *Cu*1; *Sc*2 very close to the tip of *Sc*1 and about subequal to it; *Rs* strongly arcuated; R_{2+3} very long as in this group of species, almost straight beyond the origin; R_2 semiperpendicular, short, the distance on the wing margin between the tips of veins R_1 and R_2 is a little greater than R_2 alone; cell R_2 a little larger than in *noveboracensis; R*4+5 straight, not approaching M_{1+2} at the wing margin; basal deflection of *Cu*1 at the fork of *M*.

Abdomen dark, the posterior margins of the tergites paler. The colours produced by pruinosity in dried specimens are undoubtedly somewhat different from those of the alcoholic type just described. Male hypopygium similar to that of *noveboracensis* (as figured in the Proceedings of The Academy of Natural Sciences of Philadelphia for 1916, Pl. 30, Figs. 79 and 80), but differing in many important respects; the flattened dorsal pleural appendages have but few setæ along the truncated or concave apex; the long, slender, ventral arm is expanded into a paddle at the tip, this with the lower margin minutely

denticulate, the teeth coarser proximally but very minute and delicate on the distal two-thirds of the blade. The tubercle at the dorsal inner edge of the pleurite bears three very long bristles that are but little shorter than the dorsal pleural appendage. The gonapophyses and penis-guard are fused into a subcylindrical tube that is armed caudally with several needle-like points. The arrangement of these chitinized horns is about as in *noveboracensis*, but their shape and structure is very different; appendage *b* is almost straight and has the two arms of the bifid tip very unequal, the shorter one appearing as a small spine at about mid-length of the appendage; appendage *c* appears forked at its very base, the one arm very stout basally, near the apex narrowed and strongly curved; the other fork is shorter, gradually pointed and flattened to the tip, the margin with a thin line of hairs. Below (ventrad of) the tube on either side is a very large, flattened, nearly hyaline plate that is almost invisible in balsam.

Habitat.—California.

Holotype.—♂, Wildcat Cañon, San Pablo, California, September 16, 1906, (J. Chester Bradley).

The type is in the collection of Cornell University.

The only described Nearctic species that is close to *G. aciculifera* is *G. noveboracensis* Alex. (Can. Ent., Vol. 48, pp. 319, 320; 1916) of the northeastern United States. The wing venation and the structure of the male hypopygium will easily separate the two forms. In this group of species, the male hypopygium is very complicated in structure, and I am unable to correlate the remarkable structures that surround the penis-guard, with the gonapophyses found in other groups of the genus. Very few specimens of these two species have yet been discovered, and more material is needed to finally decide these homologies.

GENUS *Tricyphona* ZETTERSTEDT.

Tricyphona petiolata, new species.

Size very small; antennæ dark brown, with fifteen evident segments, those toward the tip small and nearly globular; general coloration light buff, the mesonotum with a single conspicuous median dark brown stripe; wings nearly hyaline; cell R_3 petiolate; R_2 perpendicular, at the very tip of R_1; cell M_1 lacking; cell *1st* M_2 open by the atrophy of *m;* abdomen brown, the hypopygium conspicuously light yellow.

Male.—Length about 5.5 mm.; wing 6 mm.

Rostrum and palpi dark brownish black, the former very short. Antennæ dark brownish black, with fifteen evident segments, short, the first segment elongate, the second enlarged, globular, the first flagellar segment elongate ova ; those toward the end of the organ smaller and subglobular; the last segment is elongated and constricted medially as though formed by the close approximation of two small segments. Head brownish gray.

Pronotum buffy, broadly dark brown medially. Mesonotum light buffy yellow, the præscutum with a single broad, dark brown median stripe that is narrowed at the tip and becomes obliterated before the suture; lateral præscutal stripes lacking. Pleura buffy yellow. Halteres pale basally, the knobs dark-brown. Legs with the coxæ buff; trochanters light yellow; femora brown, paler basally; tibiæ and tarsi dark brown. Wings nearly hyaline, narrow; stigma lacking; veins yellowish brown. Venation: *Sc* long, ending slightly

beyond the fork of R_{2+3+4}; *Rs* short, oblique, almost straight; R_{2+3+4} variable in length, in one wing shorter than the basal deflection of Cu_1, in the other a little longer; R_2 (the apparent *r* cross-vein; see Alexander; A New Interpretation of the Wing-venation of the Pediciine Crane-flies, Ent. News, Vol. 29, pp. 201–205, pl. 12; 1918) inserted at the extreme tip of R_1, perpendicular; cell M_1 lacking; ceil *1st* M_2 open by the atrophy of *m;* petiole of cell M_3 nearly equal to the basal deflection of Cu_1.

Abdomen dark grayish brown, the subterminal segments a little darker; hypopygium conspicuously light yellow.

Habitat.—Colorado.

Holotype.—♂, Peaceful Valley, Colorado, August 25, 1918, (T. D. A. Cockerell).

This interesting little fly is to all appearances a *Rhaphidolabis* of the subgenus *Plectromyia*, but the number of antennal segments precludes it from that group, and until more material is available I prefer to consider it a *Tricyphona* to where it will run by the keys. There are only fifteen distinct antennal segments, but the terminal one is evidently formed by the close approximation of two very small segments. The fly somewhat resembles a very small specimen of *Rhapidolabis major* Alex., but the size and venation, especially the position of R_2 and the lack of cell M_1, easily separate the two.

GENUS *Liogma* OSTEN SACKEN.

Liogma nodicornis flaveola, new subspecies.

Male.—Length 12 mm.; wing 8.3 mm.

Female.—Length 11 mm.; wing 9 mm.

This variety is similar to typical *nodicornis*, but is much more yellowish throughout. Compared with specimens of typical *nodicornis*, the following differences are apparent:

Antennæ light brown. Mesonotal præscutum with the ground colour yellowish brown with the three brown stripes rather narrow and scarcely confluent; scutal lobes only indistinctly darker; mesonotal postnotum yellowish with only the terminal third blackish. Pleura mostly yellow, a small, circular, dull black area on the mesepisternum behind the fore coxa. The extensive shiny black areas on the mesosternum before the middle coxa are not continuous across the midventral line. Abdomen pale brown.

Habitat.—Virginia.

Holotype.—♂, Great Falls, Virginia, May 19, 1915.

Allotopotype.—♀, June 7, 1915.

The northern *L. nodicornis nodicornis* (O. S.) is easily told from the pale yellowish southern race above diagnosed by its much more extensive black thoracic pattern. In the type-material of typical *nodicornis*, both varieties are represented. As typical of *nodicornis* in the strict sense the writer selects the lectotype from the material taken in the White Mts., New Hampshire.

GENUS *Tipula* LINNÆUS.

Tipula doaneiana, new name.

Tipula californica Doane (1912), non *Tipula californica* (Doane) (1908).

In 1908, Doane described under the name *Pachyrhina californica*, a species of crane-fly that both Dr. Dietz and the writer now refer to the pachyrhinoid series of the genus *Tipula*. Dietz (1918), under the misconception that it was

the 1908 name that was preoccupied, renamed this species *Tipula xanthomela*. The 1912 species is here renamed as above in honour of Prof. R. W. Doane.

Tipula ludoviciana, new species.

Belongs to the *tricolor* group; closely related to *T. sayi* Alex. (*costalis* Say); male antennæ very long, bicolorous; wings with a dark costal margin, beneath which is a vitreous streak; a narrow, brown seam along vein *Cu*.

Male.—Length about 13.5–14 mm.; wing 11.5–11.8 mm.; antennæ about 13–13.5 mm. Hing leg, femur 9.3 mm.; tibia, 11 mm.

Female.—Length about 12 mm.; wing 11.4 mm.

Male.—Frontal prolongation of the head moderately elongated, light brown, the nasus slender. Mouth-parts and palpi dark brown. Antennæ exceedingly elongate, approximately as long as the entire body, the scape light brown, the flagellar segments with the basal swelling dark brown, the pedicel light yellow, on the terminal segments more infuscated; the pedicel of the intermediate flagellar segments is six times as long as the basal enlargements; in addition to the usual black verticils, the segments are provided with a delicate pale pubescence that is easily removed. Vertical tubercle prominent, entire. Head dark with an indistinct darker median line.

Mesonotum brown, probably more or less gray pruinose in dry material, the præscutum with three very broad, dark brown stripes; postnotum pale, margined with brown. Pleura pale, probably more or less pruinose in life, with indistinct dark markings on the mesopleura, and dark brownish black on the mesosternum between the middle and hind coxæ. Halteres slender, brown. Legs with the coxæ largely pale; trochanters yellowish, dark brown apically; femora and tibiæ brown, darkest apically; tarsus brown. Wings gray, the costal region dark brown, this including cells *C*, *Sc*, *1st* R_1, *2nd* R_1, the anterior portion of *R*, and the outer end of R_2; a broad brown seam along vein *Cu* occupying the space between that vein and the weak degenerate anal vein immediately behind it; a vitreous longitudinal stripe behind the brown costal margin, this including the posterior portion of cell *R*, the anterior portion of *M*, and the base of cells R_3 and R_5; veins dark brown. Venation: *m-cu* short but distinct; petiole of cell M_1 about as long as cell *1st* M_2.

Abdominal tergites light brown, the transverse impressed areas on either side near the base of the segments very distinct, black; sternites paler. Male hypopygium small, compressed, as in the *tricolor* group, with the sclerites fused into a continuous ring. Ninth tergite with the median lobe very depressed, broad, the posterior margin with a very flattened, V-shaped notch which is black and roughened; no pencil of hairs on the sides of the median lobe. Outer pleural appendage oval, flattened, pale, with sparse black hairs; inner pleural appendage simple in structure. Ninth sternite carinate. Eighth sternite unarmed.

Female.—Similar to the male; antennæ short, much darker coloured than in the male; ovipositor with the tergal valves long, slender, straight; sternal valves short, very compressed, the tips subacute.

Habitat.—Louisiana.

Holotype.—♂, Morgan City, Louisiana, June 18, 1917. (Cornell University Expedition, Lot 542, sub. 16).

Allotopotype.—♀.

Paratopotypes.—2 ♂'s.

The type is in the collection of Cornell University.

Tipula ludoviciana is allied to, and superficially resembles, *T. sayi* Alex. (*costalis* Say) which has the antennæ of the male short, about reaching the base of the abdomen; no dark seam along the vein *Cu;* the petiole of cell M_1 much shorter, and the colorational and hypopygial details different.

This new species of *Tipula* has the male antennæ of a length that is quite unique among the known nearctic species of the genus, but which is equalled or exceeded in certain exotic forms.

Tipula plutonis, new species.

Similar to *T. coracina* Alex. of northern Alaska; general coloration gray, the præscutal stripes darker; wings almost clear; abdomen dark gray with the lateral margins of the tergites broadly yellowish; male hypopygium very simple in structure, the ninth tergite broadly transverse, the posterior margin almost straight across with a tiny V-shaped median notch; outer pleural appendage very large and tumid, working transversely across the genital chamber; ninth sternite with a deep, V-shaped notch.

Male.—Length 10.5 mm.; wing 11.5 mm.

Frontal prolongation of the head dark brown, the nasus distinct; mouthparts dark brown. Antennæ short, the basal segments paler brown, the flagellum dark brown throughout; segments of the flagellum short-cylindrical with the terminal swelling about equal to the basal enlargement, the segments but feebly constricted at midlength. Head light gray, more obscure posteriorly.

Mesonotal præscutum dark gray with four indistinct dark brown stripes, the median pair very indistinctly divided by a capillary line. Remainder of the mesonotum dark gray, the scutal lobes indistinctly marked with brownish. Pleura gray, the dorso-pleural membranes more yellowish. Halteres yellowish brown, the knobs dark brown. Legs with the coxæ dark gray, tipped with paler; trochanters yellowish, tipped with blackish; remainder of the legs broken. Wings subhyaline or very pale grayish; stigma distinct, brown; a distinct obliterative streak extending from before the stigma through cell *1st* M_2; veins dark brown. Venation: *Rs* almost straight; cell M_1 very deep, the petiole short, about equal to a or a little less than *r-m;* cell *1st* M_2 pentagonal; *m-cu* obliterated by the punctiform contact of Cu_1 on M_{3+4}.

Abdomen dark gray, the lateral margins of the tergites broadly yellowish, the posterior margins of the tergites and sternites very narrowly and indistinctly ringed with silvery. Male hypopygium of very simple structure. Ninth tergite flattened, broadly transverse, almost rectangular, the posterior margin almost straight across and with a minute median V-shaped notch. Ninth pleurite very extensive, the suture indicated by a distinct curved line beneath, the proximal ventral angle narrowed and tufted with a few long, silky hairs. Outer pleural appendage very large and tumid, the ventral face blackened, the surface of the appendage covered with a few short appressed hairs; inner pleural appendage represented by a small flattened, subcircular lobe. The pleural appendages work across the genital chamber after the fashion of the Limnobiini, not against the ninth tergite as in most species of the genus. Ninth sternite profoundly notched by a narrow, V-shaped incision. Eighth sternite

unarmed. Eighth tergite, except at the ends, concealed beneath the seventh tergite.

Habitat.—California.

Holotype.—♂, Alta Meadow, Sequoia National Park, California, altitude 9,000 feet, July 19, 1907, (J. Chester Bradley).

The type is in the collection of Cornell University.

This primitive little *Tipula* bears a certain resemblance to *T. coracina* Alex. of Alaska, and the two probably belong to the same group of the genus. The type of *T. plutonis* was sent to Prof. Doane for comparison with his types; he notes the general resemblance of the species to *T. spernax* O. S., to which, however, the species is at most distantly related. The fused hypopygium of *T. spernax* with a broad, median tergal lobe will easily separate the species from any other similar member of the genus.

Tipula shasta, new species.

Belongs to the *angustipennis* group, close to *T. angustipennis* Lw., but with the thorax darker coloured, the wings of a very decided reddish yellow tinge, the abdomen without a black dorso-median stripe, and the details of the male hypopygium different.

Male.—Length 20–21 mm.; wing 17–18 mm.

Frontal prolongation of the head black, moderately elongated, the nasus distinct; mouth-parts black. Antennæ with the first segment black; the second segment and basal two-thirds of the first flagellar segment pale brown to almost black; remainder of the antennæ black; flagellar segments with the basal swelling moderate in size. Head broad, genæ swollen, eyes small. Head dark brown with a very narrow, pale, whitish yellow line surrounding the eyes.

Mesonotal præscutum buffy, more dusky anteriorly, clearer near the suture; præscutum with four very distinct, dark brown stripes, the median pair long, slightly narrowed behind, separated from one another by a more or less distinct capillary line; the lateral stripes, and, less distinctly, the median stripes, are surrounded by a narrow, intensely black border; scutum buffy, the lobes dark brown, surrounded by narrow, black margins; scutellum with three blackish lines; postnotum dark. Pleura dark brown, indistinctly blotched with still darker markings. Halteres orange, the knobs and terminal portions of the stem dark brown. Legs with the coxæ grayish brown; trochanters brown, femora reddish with the tips narrowly dark brown; tibiæ pale reddish, the tips narrowly and indistinctly darkened; tarsi with the basal segments dull reddish, gradually passing into a dark brown. Wings with a strong, saturated, reddish yellow tinge, clearer, more yellow, on the costal region, especially cell *Sc*, more brownish on the posterior portion and the wing-apex in cells R_2 and R_3; stigma large, dark brown; a small hyaline obliterative area before and beyond the stigma; an indistinct hyaline line across the base of cell *1st* M_2; a large pale blotch toward the end of cell *M*, as usual in this group of species; the only nearctic species of *Tipula* known to the writer with wings of this colour is *T. ultima* Alex. (*flavicans* Fabr.) of the eastern United States. Venation: cell M_1 short-petiolate, the petiole a little longer than *r-m; m-cu* distinct or punctiform.

Abdomen with the first segment blackish; remainder of the abdomen bright reddish, the lateral margins of the tergites more obscure; third abdominal tergite usually a little darker in colour than the other segments. Male hypopy-

gium very similar to that of *T. angustipennis*, but more enlarged and compressed. Ninth tergite large, gradually narrowed posteriorly, the caudal margin with a very broad and deep V-shaped notch, the apices of the adjacent lobes bluntly rounded, and each tipped with a small, chitinized tubercle. Ninth pleurite complete, large, the posterior angle produced caudad into a broad, flattened, obtuse chitinized lobe; proximal ventral angles of the pleurite each with a very prominent yellowish fleshy lobe that juts caudad, the apex bifid by a broad notch; outer pleural appendage small, cylindrical to subclavate, with numerous long, pale hairs; inner pleural appendage a large, compressed blade whose apex juts into the notch of the tergite. Ninth sternite with the adjacent margins contiguous, from the opening a long, slender, chitinized rod and a few long, coarse, yellow hairs protrude. Eighth sternite unarmed, somewhat projecting behind. Eighth tergite entirely concealed beneath the seventh tergite.

Habitat.—California.

Holotype.—♂, Foothills of Mount Shasta, California, May 17, 1914.

Paratopotypes.—Males with the type, May 16, 17; *paratypes* two ♂'s, Yosemite Valley, California, May 22, 1908, (E. T. Cresson, Jr.).

The type is in the collection of Dr. Dietz; paratypes in the collection of the writer and the American Entomological Society.

This beautiful, yellow-winged *Tipula* is related to *T. angustipennis* Lw. of northern North America, but is abundantly distinct. The type material was very kindly sent me by Dr. Dietz with the indication that it probably represented a new species. The writer could not reconcile the fly with any of the descriptions, and sent the material to Prof. Doane for his opinion and comparison with his extensive series of Western Tipulas. He also believes the species to be close to *T. angustipennis*, which is certainly the case, but the two species show numerous constant differences. Prof. Doane writes that he has a female of this species from the Yosemite Valley.

NOTES ON PELENOMUS SULCICOLLIS FÄHRS. (CURCULIONIDÆ).

BY ROBERT MATHESON, ITHACA, N.Y.

During the past three seasons a small patch of some five or six square yards of fringed loosestrife (*Steironema ciliatum* (L) Raf.) growing on the bank of a small stream which passes near my house has been badly destroyed by some foliage feeding insect. My attention was attracted to it this season as nearly every plant, and it was almost a pure stand of this species, was practically destroyed, the leaves having been completely riddled, and many of the stalks badly eaten. Previous examinations had shown that a small coleopterous larva was doing the work, but I had not noted them in any considerable numbers. Late in July (1918) I found numerous small silken cocoons scattered over the under side of the leaves of the loosestrife, and on later examination I found many small snout beetles feeding on the plants.

As the beetle seemed to be a species about which very little was known, I reared a few of the larvæ and made a close examination for the place of egg deposition. My efforts were rewarded and, though rather late in the season, I found all stages of the beetle. The beetle was kindly identified by Mr. C. W.

Leng as *Pelenomus sulcicollis* Fährs. (Curculionidæ), and as nothing has ever been published on the biology of this genus I think these few notes may be of interest.

The beetles were very abundant during August and early September, oftentimes five or six beetles being present on a single leaf. They feed largely on the leaf tissue, skeletonizing it; though this year, on account of the almost complete destruction of the leaves by the larvæ, the beetles were forced to feed on the stems and mid-ribs of the leaves. These they cut into with their mandibles, and then eat the softer parts within. During the latter part of September the beetles became fewer and fewer in numbers, and there is no doubt that they hibernate somewhere amongst the fallen leaves and rubbish.

After some search I found where the eggs are laid. Just beneath the lower epidermis of the leaves near the veins I found a few empty egg-shells. (Plate XVIII, Fig. 3). The eggs are laid singly and, as a result of the oviposition, the area in which the egg is laid dies and becomes brown. This dead area shows only on the lower surface, evidently the parenchyma not being sufficiently damaged.

The larvæ feed on the lower surface of the leaves almost entirely. They destroy the lower epidermis and parenchyma, leaving the upper epidermis intact. This soon dies, and large open spaces are left, giving the appearance shown in Plate XVIII, Figs. 1 and 2. As the larvæ do not possess legs they evidently move by the action of the large flat surfaces on the ventral side of each segment. These can evidently be moved slightly by muscular action, though I have never seen the larvæ actually crawl.

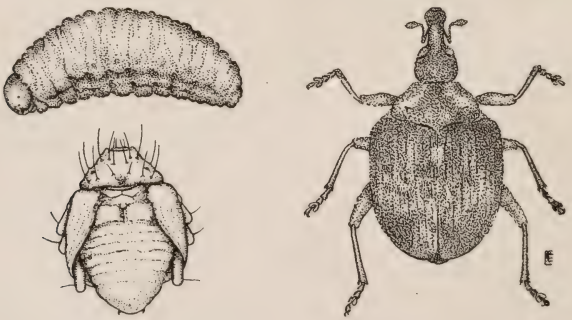

Fig 23.—*Pelenomus sulcicollis* Fährs.; mature larva, pupa and adult.

When mature the larvæ spin small silken cocoons on the under surface or axil of the leaf, and in the destroyed ends of the stem. These pupal cases are rather beautiful, especially when a number of them are formed close together. (Plate XVIII, Fig. 5.) In these silken cells the larvæ transform to pupæ within a few days, and the adults emerge in about two weeks. After emergence the beetles feed quite extensively before going into hibernation. So far as my observations go there is undoubtedly only a single generation a season.

Pelenomus sulcicollis Fährs.—1. Destruction of foliage. 2. Destruction of plant. 3. Eggs in leaf tissue. 4. View of destroyed plants. 5. Pupal cases on stem and leaves.

DESCRIPTION OF STAGES.

The egg.—The egg was not observed though egg-shells were found in the place of oviposition.

The larva. — The mature larva is dirty white to almost pure white in colour. The head is rather strongly chitinized, and the prothorax possesses a narrow, chitinized area on the dorsal surface. The rest of the larva is soft and possesses no defensive structures, even setæ of all kinds being absent. The head is small, rounded, almost spherical in shape, and about one-half as wide as the thorax. Two black ocelli are present on each side of the head just above the mandibles. The body of the mature larvæ is strongly curved dorsally, much wrinkled by transverse depressions, and tapers slightly in both directions. The ventral surface is flattened. Legs are absent. The larva measures 4 mm. in length.

The pupa. — The pupa is broad, short and somewhat flattened. It is at first pure white, later darkening, and before transforming assumes the dark colours of the beetles. The wing-pads lie curved under the body, passing between the second and third pair of legs. The prothorax is strongly tuberculate, and from the tubercules arise long, chitinized setæ, about 14 in all. Similar setæ arise from the distal lateral ends of the femora, the head and beak. These long setæ prevent the soft body of the pupa from coming in contact with the pupal cell. The pupa measures 2.5 mm. in length by 2 mm. in extreme breadth.

The beetle. — The beetle is a rather pretty snout beetle, and is described by Blatchley and Leng in their "Rhyncophora of North-eastern America" as follows:—"Broadly oval. Dark piceous, clothed with brown scales having a brassy tinge and variegated with pale ones, the latter condensed on the sides and on basal half of dorsal channel of thorax, and forming on the elytra a small post-scutellar and numerous smaller subquadrate spots; antennæ and legs reddish-brown. Beak scarcely longer than head, widened toward apex, densely and finely punctate. Thorax nearly twice as wide at base as long, dorsal channel entire, widening into a fovea in front; lateral tubercles acute, disc finely and closely punctured. Elytra one-fourth wider at base than thorax, sides broadly rounded, striæ punctured; intervals feebly convex, the alternate ones slightly more so. Length 2.3–2.5 mm."

THE SYNONYMY OF HELICE CHAMBERS AND THEISOA CHAMBERS. (MICROLEPIDOPTERA).

BY ANNETTE F. BRAUN, CINCINNATI, O.

The description of the venation of *Theisoa* by Chambers in his characterization of that genus, and his figure in the Journal of the Cincinnati Society of Natural History were both made from male specimens, as an examination of material of both sexes shows. Singularly enough, subsequent studies on this genus have also been confined to males, as must be concluded from the published notes by Mr. Busck (cf. Proc. Ent. Soc. Wash., XI, 94, 1909), where, in establishing the synonymy of *Cacelice* and *Theisoa*, he refers to the figure of the "characteristic venation" of this genus, as shown in *Cacelice permolestella* Busck. Observations made by the writer on *Theisoa constrictella*, *T. permolestella* and *Helice pallidochrella*, and presented below reopen the interesting question of

the relationship of *Theisoa* and *Helice*. For earlier references to these genera see Dyar's List, Nos. 5592, 6130, 6182.

In *Theisoa constrictella*, males (Fig. 24–a) in the fore wing, veins 7 and 9 are out of 6, with 8 absent; here the transverse vein is much nearer to 10 than to 9. In the female (Fig. 24–b)8 is present, and 9 separates from the stalk of 6, 7, 8 and 9 sooner than in the male, thus showing a less specialized condition. In the hind wing of the male (Fig. 24–c) the vein apparently forming the upper margin of the cell reaches the margin of the wing just *below* the apex; if followed toward base, it is seen to curve downward, being more or less distinctly connected with lower margin of cell near the middle of the wing by a very short discal vein, from thence to base it is obsolescent. In one specimen, the hind wing on one side (Fig. 24–d) shows an additional vein lying costalward of this; it is indistinct from base to middle, where it makes a scarcely noticeable bend toward the discal vein, and reaches the costa at about two-thirds the wing length. I consider this vein 7 and its presence in this instance an atavistic character. In the hind wing of the female (Fig. 24–e) the upper margin of the cell extends almost straight from base, reaching the *costa* almost at apex; it is rather indistinct in its basal half. Its course in the basal half is exactly that of the "additional vein" in one male wing, above mentioned; in its apical half its course is such as to lead to the inference that it is formed by the coalescence of the vein, which normally in the male forms the upper margin of the cell with the "additional vein." There is no indication of a discal vein in the female. From these observations I conclude that the venation of the hind wing in this species was derived from a type in which both veins, 6 and 7, were present and separate; in the process of evolution, the male and female show a divergence, in direction of development to the extent that in the male vein 7 has disappeared completely by obsolescence leaving vein 6 to form the upper margin of the cell, while in the female, 6 has coalesced completely with 7, the only evidence of the process remaining being the costal ending of the apical vein as contrasted with its terminal ending in the male.

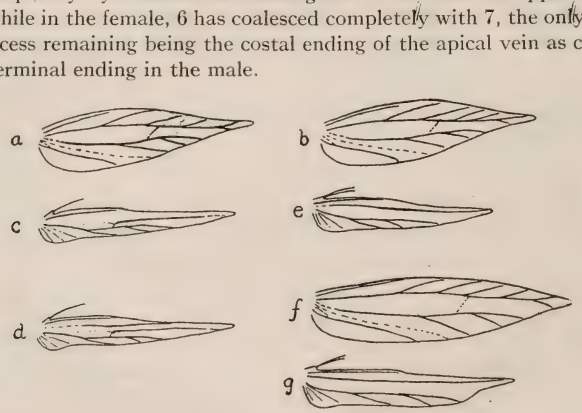

Fig. 24.

In order to determine whether the same difference in venation exists between the sexes of *Theisoa permolestella*, an examination of a series of specimen. was made; this examination revealed that all the specimens of *T. permolestella*

are males. The venation agrees with the usual venation of the male *T. constrictella*. No indication of vein 7 was found in the hind wing; vein 6 reaches the margin considerably below the apex.

Helice pallidochrella is found to be represented by females only. The venation agrees with that of the female *Theisoa constrictella;* with slight differences indicating a more generalized condition, *viz.*, in the forewing (Fig.24–f) 9 is separate from the stalk of 6, 7 and 8; in the hind wing (Fig. 24–g) 6+7 is distinct to the base, but its course is exactly that of this vein in *T. constrictella* female.

My conclusion is that *Theisoa permolestella* is the male of *Helice pallidochrella*. In the genus *Helice* we have an extremely specialized Gelechiid genus, of which the female of one species, in venation the least specialized, has alone retained the characteristic Gelechiid shape of the hind wing. Another factor which argues against the retention of the genus *Theisoa* as a Cosmopterygid genus, is that the costa of the hind wing does not show a degree of modification in outline corresponding to the specialization in venation.

The supposed specific differences separating *Theisoa permolestella* from *Helice pallidochrella*, are not confined to either, but are shown in individuals of both. Late summer specimens of males (supposed *T. permolestella*) and females (*H. pallidochrella*) show a dark tornal spot opposite the costal spot at the apical third, which is more or less distinct, sometimes as large as the costal spot.

The synonymy of the genera and species under discussion will, therefore, stand as follows:

Helice Chambers, Can. Ent., V, 187, 1873 (Type *H. pallidochrella* Chambers).
syn. *Theisoa* Chambers; *Cacelice* Busck.

1. *pallidochrella* Chambers.
   syn. *gleditschiœella* Chambers; *permolestella* (Busck).
2. *constrictella* (Zeller).
   syn. *bifasciella* (Chambers).
3. *multifasciella* (Chambers).

NOTES ON SULCACIS LENGI DURY* AND ORCHESIA CASTANEA MELS.,* BREEDING IN FUNGI.

BY HARRY B. WEISS, NEW BRUNSWICK, N.J.

Sulcacis lengi Dury.

This species, which was described by Dury in 1917 (Syn. of Col., Fam. Cisidæ (Cioidæ) of Amer. N. of Mex.-Jour. Cin. Soc. Nat. His., Vol. XXII, No. 2, p. 20) from Vermont and Cincinnati specimens, has recently been found in New Jersey breeding in the following fungi,**—*Lenzites betulina* L., *Polyporus versicolor* L., *Polyporus gilvus* Sch., and *Polyporus hirsutus* Wul., all of which occur on dead wood of deciduous trees. It was most abundant in *Polyporus versicolor* at Monmouth Junction, N.J., and occurred only sparingly in *Polyporus hirsutus*.

Hibernation appears to take place in both larval and adult stages, as both of these forms were found on March 1, but no pupæ. By keeping the infested

*Kindly identified by C. W. Leng.
**Identified by Erdman West.

fungi in a warm room for several weeks, pupæ were finally secured. Most of the larval feeding was done in the context, and it was here also that pupation took place.

Full-grown Larva.—Length 1.7 mm.; width 0.42 mm. Grub-like; slightly curved when viewed laterally; subcylindrical, tapering slightly anteriorly; skin somewhat wrinkled, creamy white except for mandibles and adjacent mouth-parts which are dark; ocelli lateral, one pair and a single one above; body segmentation distinct; body bearing a few scattered hairs; first thoracic segment twice as long as second; remaining thoracic and abdominal segments subequal in length; ninth and last abdominal segment bears a dorsal pair of dark, strongly chitinized, comparatively large hooks curved anteriorly; each leg terminated by a fine curved hook.

Pupa.—Length 1.22 mm.; width 0.48 mm. Creamy white, sparsely hairy, posterior end terminated by two parallel spines.

Orchesia castanea Mels.

This species was described by Melsheimer in 1846 (Proc. Phil. Acad. Nat. Sci., III, 57). Blatchley (Coleoptera of Indiana) records it from Indiana in woody fungi and Smith (N. J. State Mus. Rept. 1909) lists it from several points in New Jersey from "hard fungi" on trees.

During the first week of March, larvæ of this species were plentiful in *Trametes suaveolens* L., on willow at Kingston, N.J., and to a slight extent in *Lenzites betulina* at New Brunswick, N.J. In view of this it appears that overwintering takes place in the larval stage. It undoubtedly breeds in other species of fungi as *Trametes suaveolens* and *Lenzites betulina* are not what one would call hard fungi, and as Schwarz (Psyche I, 1876, pp. 145–148) mentions it as inhabitating a fungus growing on a dead beech. The larva feeds in the context and tubes, and pupation, which requires about eight days in April, occurs in the context.

Full-grown Larva.—Length 7 mm.; width 1.6 mm.; subcylindrical, slightly curved when viewed laterally; sparsely hairy; segmentation distinct; creamy white except for head and mouth-parts, which are brownish; antenna conical, light, three-jointed, distal segment bearing two hairs on tip; ocelli lateral, five in number, three in a row and two single ones posterior to them; first thoracic segment one and one-half times length of third; second thoracic segment somewhat constricted medially; nine abdominal segments; ventral abdominal surface wrinkled; legs three-jointed, each terminated by a dark, chitinized hook; each leg bears a few spine-like hairs and a group of short spines on anterior basal portion; spiracles on first prothoracic and abdominal segments one to eight.

Pupa.—Length 5–6.5 mm.; width 1.8–2.3 mm.; elongate, rounded anteriorly and pointed posteriorly; creamy white; head and prothorax bearing numerous large and small acuminate spines each with a tuberculate base, each spine bearing a long hair which arises just below the tip, the largest spines occurring near lateral and anterior margins of prothorax; a pair of similar spines occur on dorsal surface of second and third thoracic segments; each abdominal segment bears a transverse row of dorsal spines, the largest ones being median and lateral; abdominal spines slant posteriorly; last abdominal segment bears a pair of small hooks curved upward and anteriorly.

THE PANURGINE BEES OF NORTH DAKOTA AND A NEW EPEOLUS. (HYM.)

BY O. A. STEVENS, AGRICULTURAL COLLEGE, N. DAK.

Since 1910 the writer has spent as much time as other duties would permit collecting and studying the flower-visiting insects, chiefly bees, of this state. A list of the wasps had been published (Ent. News, Vol. 28, pp. 419–423, 1917) Records of some of the bees have been published as follows:

Cockerell—Can. Ent. Vol. 43, p. 390, 1911.—*Neopasites* (*Holcopasites*) *robertsoni* Cwfd. and *Andrena hirticincta* Prov.

Crawford—Can. Ent., Vol. 45, pp. 155–156, 1913.—*Prosopis stevensi*, n. sp.
—Proc. U. S. Mus., Vol. 48, p. 579, 1915.—species of *Panurginus*.
—Insec. Ins. Menst., Vol. 3, pp. 125–126, 1915.—*Holcopasites stevensi*, n. sp.

Franklin —Ent. News, Vol. 26, pp. 413–415, 1915.—species of *Bombidæ*.

Swenk —Univ. Nebr. Studies, Vol. 12, No. 1, 1912.—species of *Nomada* (3 new).
—Ibid., Vol. 15, No. 2, 1915.—species of *Nomadidæ* (8 new) and *Stelididæ*.

The present paper presents records of the *Panurgidæ* of Ashmead, and also a new *Epeolus*. Prof. Cockerell has kindly suggested that these described species were new and has looked over the descriptions. The types will be placed in the U. S. National Museum.

Family MACROPIDÆ.

Macropis morsei Robertson. (det. Crawford).

Fargo, Kensal, New Rockford, Deering, Kenmare, Pleasant Lake and Granville. Mostly at flowers of *Steironema;* at one time many of both sexes were found sucking nectar at *Lactuca pulchella* (which was growing near a quantity of *Steironema*). Occasional specimens at *Apocynum androsæmifolium* and *A. hypericifolium* (males), *Petalostemon oligophyllum*, *Onagra strigosa*, *Solidago canadensis*, *Symphoricarpos occidentalis* and *Taraxacum taraxacum;* June 26 to Aug. 11.

Family DUFOUREIDÆ.

Halictoides marginatus (Cresson). (det. Crawford).

Fargo, Valley City, Lakota, Rugby, Monango (J. F. Brenckle). Mott (J. R. Campbell), Dickinson (C. H. Waldron). A rather common bee, mostly at sunflowers (*Helianthus petiolaris*, *H. scaberrimus* and *H. tuberosus*), also at *Grindelia squarrosa;* Aug. 9 to Sept. 18.

Halictoides maurus (Cresson). (det. Crawford).

Cavalier, Valley City, Mandan, Glen Ullin, Leeds, Minot, Marmarth. A fairly common bee at flowers of *Campanula rotundifolia;* June 30 to Aug. 5.

Family PANURGIDÆ.

Perdita canadensis Crawford (det. Crawford).

Sheldon, Pleasant Lake, Williston and Dickinson (C. H. Waldron). At flowers of *Helianthus petiolaris* and *H. scaberrimus;* July 25 to Aug. 21. Some twenty of each sex and several pairs taken in copula. The male has not been described. The more strongly marked ones agree quite closely with the description of that sex of *P. lacteipennis* Swenk and Cockerell. In others the yellow markings are almost entirely absent. The mandibles are usually yellowish-

red medially, darker red apically and greenish black basally. The females agree well with the original description. The spots on the first abdominal segment are often absent, and the bands on the others are sometimes all interrupted medilly. Mr. Crawford writes that he is uncertain of the validity of the species.

Perdita bruneri Cockerell.

Fargo, Enderlin, Sheldon, Valley City, Jamestown, Bismarck, Pleasant Lake, Rugby, Minot, Schafer, Williston and Dickinson (C. H. Waldron); Aug. 6 to Sept. 15. A common bee and much the most common of the genus in the State. Only four females were taken at Fargo previous to 1917, when it was found in considerable numbers. Mostly at flowers of *Grindelia squarrosa;* also at *Chrysopsis villosa, Aster multiflorus* and *Helianthus petiolaris.*

Perdita swenki Crawford.

Valley City and Pleasant Lake at *Grindelia squarrosa, Chrysopsis villosa, Helianthus maximiliani* and *Solidago canadensis;* Aug. 11 and 13. Taken only the two times, although in considerable numbers at Valley City. These two species determined by Prof. Cockerell some time ago as *P. cockerelli* Cwfd. and *P. bruneri* Ckll.

Perdita tridentata, new species. (Fig. 25, 1).

Male.—Length 4 to 5.5 mm. Head and thorax greenish-blue. Yellow markings as follows: base of clypeus with a broad median and narrow marginal extensions, supra-clypeal spot about half as high as wide, lateral face marks gradually or irregularly narrowed to a point at about the upper level of antennal sockets (see Fig. 1), mandibles except tips, scape and under side of flagellum (less so on first three joints); tegulæ, wingbases and small spots on pronotum; front half of anterior legs for their entire length, a narrower stripe on intermediate ones, knees of posterior legs and often a very narrow stripe on their tibiæ; bands on first, fourth and fifth segments interrupted medially, those on second and third slightly notched.

Apex of clypeus, labrum, upper side of flagellum and a small spot on apex of scape, light brown; legs and abdomen dark brown; wings clear but nervures dark, apex of abdomen triangular but obtusely rounded.

Type No. 6372. The type is from a series of 13 specimens taken on *Helianthus petiolaris* at Pleasant Lake, North Dakota, Aug. 11, 1913. Two were taken on *H. scaberrimus* near Sheldon, Aug. 14, 1916, and one on *H. petiolaris* at the same place Aug. 21, 1918.

"A species of the *affinis* group," writes Prof. Cockerell. The abdomen is very much like that of *P. swenki* Cwfd. The clypeal marking is somewhat variable, the central extension sometimes quadrate and covering a large part of the clypeus, but more commonly rounded and shorter, the lateral extension sometimes nearly absent. In one specimen the clypeus is nearly all dark and the abdominal bands are considerably reduced. Supra-clypeal mark often notched above, sometimes almost divided.

Perdita laticincta Swenk and Cockerell.

Sheldon, Pleasant Lake and Dickinson (C. H. Waldron). All at *Helianthus petiolaris;* July 28 to Aug. 21. Prof. Cockerell has confirmed the identification of this and the next two species.

Perdita citrinella Graenicher.

Minot and Granville. At *Petalostemon oligophyllum;* July 8 and Aug. 22, five females, eleven males.

Female.—Dark sutures of head and thorax quite prominent; two specimens have tibiæ dark except knees, middle tarsi dark, ventral surface of abdomen dark medially, and scape and upper side of flagellum dark.

Male.—Closely resembles the female. Hind tibiæ usually dark behind; abdomen usually with dark triangular patches at sides of segments 2 to 5.

The males does not seem to have been previously described, although Crawford recorded* a specimen from Medicine Hat, Alberta, Canada. The markings of both sexes vary quite a little, but there is no suggestion of intergrading with the following species. In a series of eight males taken at the same time, considerable variation is known. The dark lines next the eyes are shorter than in the female, but the spots between these and the antennæ are prominent, sometimes each occupying one-fourth the width of the front; well developed spots are sometimes present at sides of lateral ocelli and small ones behind apex of eyes. Two have lateral brown lines on the mesoscutum, while one has suffused brown lines both medially and laterally, and nearly complete bands on abdomen. One has hind tarsi yellow.

Perdita perpallida Cockerell.

Sand hills near Sheldon, Aug. 12, 1916, and Aug. 21, 1918, at *Petalostemon villosum;* ten females, seven males. This species would seem to have been expected where the preceding was taken, and vice versa. This plant occurs only in this part of the State and near Pleasant Lake and Towner (not far from where *Perdita citrinella* was taken); *P. oligophyllum* and *purpureum* are common plants throughout the State.

Perdita martini Cockerell.

1895.—*Perdita martini* Cockerell, Proc. Acad. Nat. Sci. Phila., 1895, p. 14, male.

Male.—Agrees closely with the original description. The yellow on the face extends about to the middle of the anterior ocellus, its upper line irregular, being depressed under the lateral ocelli and slightly produced next the eye, a narrow line following the direction of its upper border reaching the lateral ocellus. Brown of the antennæ above mostly limited to the junctions of the first four or five joints of the flagellum; yellow on cheeks extending fully two-thirds the length of the eyes.

Meso-pleuræ with a broad yellow mark extending from front coxæ to midway between middle coxæ and tubercles; middle tibiæ with a dark spot above, posterior tibiæ dark, and femora on apical half both above and below; posterior tarsi brownish; stigma yellow, nervures brownish.

Female.—Length 5 mm. Yellow on clypeus, labrum, a low supra-clypeal spot, spot behind base of mandibles, lateral face marks extending from middle of clypeus to slightly above base of antennæ with an irregular margin, scape of antennæ and lower side of flagellum, tegulæ, tubercles and a line on prothorax connecting them. Legs with coxæ dark, trochanters yellow; anterior yellow except a spot in inner side of femora; middle with a larger spot on femora, and a small one on outer side of tibiæ; posterior dark except knees. Dark bands of

*Can. Ent. vol. 44, p. 359, 1912.

abdomen rather more pronounced than in male, the first three slightly produced backward at the sides.

Minot, North Dakota, Aug. 22, 1915. One of each sex on *Grindelia squarrosa*. Allotype No. 9293; male No. 9294. The female runs in Cockerell's table (1896) to *zonalis* Cress. or *rectangulata* Ckll. It resembles the latter in face markings. Mr. E. T. Cresson, Jr., has kindly compared these with the type of *P. martini* and considers them identical. He notes: "yellow of cheeks to 1/2 eye and black of occiput extends nearly to lower orbit level; mid-tibiæ not darkened, post-tibiæ darkened above, all femora immaculate; nervures pale and all pale parts more whitish than yellow." He also sends a sketch of the pleural markings, which shows a rather greater and more irregular extension of yellow on the fore part of the mesopleuræ.

Greeyleyella beardsleyi Cockerell. (det. Crawford).

1907.—*Panurginus malvastri* Swenk and Cockerell, Ent. News, Vol. 16, p. 179.

Dickinson, two females July 4, 1912 (C. H. Waldron), two females and a male July 4, 1914; Gascoyne, June 19, 1918, one pair in copula, five males and three females; Mott, July 7, one male. All at flowers of *Malvastrum coccineum*.

To the list of species *Panurginus* which Crawford has published *, a number of new localities may be added and the complete list is given, herewith. *P. innuptus*, *nebrascensis* and *renimaculatus* are quite common bees, the others less so.

Panurginus innuptus Cockerell.

Fargo, Nicholson, Valley City, Bismarck, Dickinson (C. H. Waldron), Marmarth, Lakota, Stanley and Minot. At flowers of *Helianthus annuus* (cult.), *H. maximiliani*, *H. tuberosus* and *H. strumosus*, *Brauneria pallida*, *Ratibida columnaris*, *Solidago canadensis*, *Grindelia squarrosa*, and *Centaurea jacea* (cult.); July 4 to Sept. 11.

Panurginus renimaculatus Cockerell.

Fargo, Jamestown, McKenzie, Bismarck, Dickinson (C. H. Waldron), Sentinel Butte, Grand Forks, Lakota, Crary, Perth, Devils Lake, Minot and Williston. Mostly at flowers of *Grindelia squarrosa*, occasionally at *Aster multiflorus*, *A. paniculatus*, *A. chinensis* (cult.), *Boltonia asteroides*, *Helianthus maximiliani* and *H. petiolaris;* Aug. 5 to Sept. 22.

In addition to the characters given by Crawford for the male, the wings are clear, and the dorsal surface of the first abdominal segment closely punctured up to the depressed apex (*nebrascensis* has smoky wings and first segment with more or less of a smooth shining space before the depressed apex, and a smooth, slightly raised median line.)

Panurginus nebrascensis Crawford.

Fargo, Valley City, Jamestown, McKenzie, Bismarck, Lakota, Crary, Devil's Lake, Granville, Minot, Tolley, Williston. Mostly at flowers of *Grindelia squarrosa*, also at *Chrysopsis villosa*, *Cuscuta gronovii* (1 male), *Petalosteon oligophyllum*, *Solidago canadensis* and *Taraxacum taraxacum;* Aug. 5 to Sept. 28.

Panurginus simulans Swenk and Cockerell.

Fargo, Williston and Dickinson (C. H. Waldron). At flowers of *Helianthus annuus* (cult.), *H. maximiliani*, *H. petiolaris* and *Taraxacum taraxacum;* July 28

*Proc. U. S. Mus., vol. 48, p. 579, 1915.

to Sept. 8. I have never been quite satisfied with the disposition of this species, but Mr. Crawford writes that he has twice compared it with the types.

Panurginus piercei Crawford.

Fargo, Valley City, Dickinson (C. H. Waldron), Monango (J. F. Brenckle). Mott (J. R. Campbell), Wales, Lakota, Crary and Perth. At flowers of *Grindelia squarrosa, Helianthus annuus* (cult.), *H. maximiliani, H. scaberrimus, H. tuberosus* and *Solidago rigida;* Aug. 8 to Sept. 16.

Two other species of *Panurginus* have been collected but not yet determined. One is a species related to *P. parvus* Rob. flying in July; the other is autumnal and probably related to some of the eastern forms.

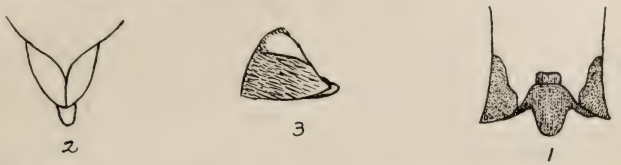

Fig. 25.—1. *Perdita tridentata*—face markings of type.
2 and 3. *Hesperapis carinata*—dorsal (fig. 2) and laterol (fig. 3) view of seventh and eighth abdominal segment.

Hesperapis carinata, new species.

Male.—Length 10–11 mm. Black with dense ochraceous pubescence, which is paler on the face and pleuræ, also on the thorax above in some specimens; face narrowed below, about as long as the median width; vertex smooth and shining, produced but very little beyond the eyes; antennæ not elongate, black; the flagellum reddish beneath, its joints scarcely longer than wide except the first and last which are slightly so, the second half as long; maxillary palpi about 750 microns, the six joints subequal; joints of the labial palpi about 425, 425, 275 and 275 microns; mandibles toothed.

Mesoscutum rather dull, the punctures of moderate size and separated by slightly more than a puncture width; propodeum rounded, the central area very smooth and shining, the sides dull and hairy; tegulæ reddish yellow; wings hyaline, nervures and stigma honey colour, the subcosta darker; first submarginal one-half longer than second, the second narrowed a little more than half; cubital nervure very straight throughout, also the second transverse-cubital, and the basal nearly so; the basal received a little anterior of the transverse medial; legs not thickened, dark, tarsi reddish yellow, the claws deeply cleft.

Abdomen dull, first segment more shining and with a thin ochraceous pubescence; the others with short black hairs and a few scattered ochraceous ones especially on the second and third; all with prominent apical ochraceous bands; seventh dorsal segment punctured at the base and with ochraceous pubescence at base and on the sides, testaceous, smooth and shining with a high, Y-shaped carina; eighth ventral somewhat narrowed and rounded at apex. (Fig. 25—2, 3).

Ten males, at flowers of *Helianthus scaberrimus* in the sand hills near Sheldon, North Dakota; August 12, 1916. Type No. 9681. Also six males at *H. petiolaris*, same place August 21, 1918. This runs in Cockerell's table (Psyche, 1916, p. 176) to *larreæ*, but Prof. Cockerell writes that the superficial resemblance is

rather to *rhodocerata*—"has quite the appearance of some *Hesperapis*, but is a peculiar and isolated species." The finding of a species of this genus previously known only from the southwestern United States, presents another interesting question in the status of this group. The first lot were taken early in the forenoon on a misty day and were inactive. The second trip proved too much the same to shed any further light on their habits.

Calliopsis coloradensis (Cresson).

Fargo, Valley City, Jamestown, Bismarck, Sentinel Butte, Lakota, Crary, Devils Lake, Perth, Granville, Minot and Williston. A common bee, usually at flowers of *Grindelia squarrosa*, also at *Chrysopsis villosa;* Aug. 4 to Sept. 10. Specimens of this species have been examined by both Cockerell and Crawford.

Calliopsis nebrascensis Crawford. (det. Crawford).

Valley City, July 26, 1913. A number at flowers of *Verbena hastata.*

Calliopsis andreniformis Smith. (det. Cockerell).

Fargo, Aug. 24 and 26, 1912. One female and two males at flowers of *Melilotus alba.* Another female on *Solidago canadensis*, Fargo, Sept. 11, 1917, is referred by Cockerell to var. *rhodophilus* Ckll.

Protandrena asclepiadis Cockerell. (det. Crawford).

Minot, Aug. 22, 1915, 2 females; Marmarth, July 4, 1918, eight females, ten males. At flowers of *Lactuca pulchella*, *Petalostemon oligophyllum*, *Symphoricarpos occidentalis* and *Astragalus gracilis* (males, about sunset).

Epeolus dacotensis, new species.

Female.—Length 12–14 mm., stout, black with four white abdominal bands which are broad, entire and nearly straight; sparse white appressed pubescence on margins of mesoscutum especially anteriorly, on collar, metanotum, tubercles and a small patch behind them, a few on base of abdomen and sides of fifth segment; otherwise entirely black; a few erect, black hairs on upper part of face, vertex, cheeks, pleuræ and mesoscutum.

Clypeus with close, shallow punctures and scattered larger ones; face slightly narrowed below; maxillary palpi with only one evident free joint which is about .3 mm. long; central lobes of mesoscutum large, low and rounded, the lateral ones small, indistinctly pointed; mesonotum coarsely and somewhat confluently punctured; wings dark, the second submarginal narrowed nearly to a point, third not narrowed; abdomen broad, band on first segment broader than the rest, concase medially (from the base of the abdomen); last two bands slightly curved at the sides; fifth segment with a large differentiated area which is scarcely at all flattened.

Male.—Entirely similar, length 12–13 mm.; apex of abdomen truncate.

Williston, North Dakota; one female (type No. 8969) Aug. 8, four males Aug. 14, 1915; one of the males on flowers of *Helianthus petiolaris*, the other, at a clay bank; Marmarth, North Dakota, July 4, 1918, two females on *Lactuca pulchel a* and one on *Helianthus petiolaris*. A very distinct and striking species probably parasitic on *Anthophora occidentalis* and *A. neomexicana*, colonies of the former nesting at Williston, the latter at Marmarth. One of the Marmarth females has the pale pubescence more abundant on the mesonotum, and extending considerably on the mesopleuræ and a little on the outer sides of the legs, especially the tibiæ.

ON THE USE OF THE NAMES LACHNUS AND LACHNIELLA. (HOM.)

BY A. C. BAKER, BUREAU OF ENTOMOLOGY, WASHINGTON, D.C.

In aphid literature much confusion has existed in the use of the two names mentioned in the title of this note, and it seems worth while to give the history of the names at the present time in order that entomologists may have the facts before them.

The genus *Lachnus* was erected in 1835 by Burmeister, and five rather diverse species were included in the genus, but no type was set. Of these species *fagi* L. and *quercus* L. were removed as the types of other and more recent genera. Various species were from time to time set as the type of *Lachnus*. These are as follows:

1840. *Aphis roboris* Lin. by Westwood.
1863. *Lachnus pinicola* Kalt by Passerini.
1908. *Aphis nudus* De Geer by Mordwilko.
1910. *Lachnus punctatus* Burm. by Wilson.
1911. *Lachnus fasciatus* Burm. by Wilson.

Now the first three fixations are invalid, since the species were not included in the original genus. The first valid fixation, therefore, is that of Wilson 1910, when he set *punctatus* as type. According to the rules of nomenclature, this species must remain the type of the genus *Lachnus*.

Unfortunately there is no uniformity of opinion as to what *punctatus* really is. In other words, the genus *Lachnus* must remain unknown until *punctatus* is definitely determined. In 1911 Wilson wrote as follows: "A careful study of *Lachnus viminalis* Boyer, Boyer's description of that species and Burmeister's description may (?) show that *L. viminalis* Boyer is identical with *L. punctatus* Burm. In that case *Lachnus* will be definitely established with *L. fasciatus* as type." According to the present writer's reasoning it would be definitely established with *L. punctatus* (=*viminalis*) as type, the species set by Wilson in 1910. Later in his 1911 paper Wilson assumed that the two species *punctatus* and *viminalis* were the same and, following his argument as just quoted, he made *L. fasciatus* the type of *Lachnus*, disregarding his earlier fixation. This was evidently done because *L. viminalis* had been fixed as the type of *Tuberolachnus* by Mordwilko in 1908. In a recent paper (1919) Wilson makes the simple statement that *fasciatus* is the type of *Lachnus*.

The writer contends that if the identity of *punctatus* and *viminalis* is conceded to be established, then according to our rules *Tuberolachnus* will become a synonym of *Lachnus* having the same species *punctatus* (=*viminalis*) as type. And this is a species very different from *fasciatus*.

The writer holds no brief for either species, but contends that without special action suspending the rules in this case it is impossible to consider *fasciatus* the type of Lachnus. He is as anxious as any other worker to have the genus *Lachnus* definitely established, but he feels that if a change of type for the genus is desirable, considering all the facts, it can be had only through action by the authorities properly qualified to suspend the rules.

The genus *Lachniella* was erected by Del Guercio in 1909, but no type was set for the genus. In 1911 Wilson stated this fact, and then placed the genus as a synonym of *Lachnus* in the following way:

7. *Lachnus* Burmeister.

Syn. *Lachniella* Del Guercio.

Type *L. fasciatus* Burm.

Since no type had previously been established for *Lachniella*, and since the genus contained a number of diverse species the placing of it thus, according to the writer's reasoning, indicates *fasciatus*, one of the included species of *Lachniella* as its type. Otherwise there would be no reason for so placing the genus. In his most recent paper (1919) Wilson has used *Lachniella* in quite a different sense, and would exclude *fasciatus* from the genus. This species, the present writer contends, is the only one that has in any way been suggested as type of *Lachniella*, and he believes that it is the type of the genus. Otherwise the genus is without a type.

This leaves the genus *Lachniella* of Wilson without a name, and to this genus we give the name *Wilsonia* and fix *Lachniella gracilis* Wilson as its type. The different genera with designated types will thus stand as follows, at least until some definite ruling has been made changing the present ligitimate type of *Lachnus*.

Genus *Lachnus* Burm.—Type *Lachnus punctatus* Burm.

Genus *Lachniella* Del Guercio—Type *Lachnus fasciatus* Burm.

Genus *Wilsonia* Baker—Type *Lachniella gracilis* Wilson.

References.

1835. Burmeister—Handbook Entom. II, p. 91.
1840. Westwood—Int. Mod. Class. Insects II, Synopsis, p. 118.
1863. Passerini—Aphididæ Italicæ, p. 62.
1908. Mordwilko—Ann. Mus. Zool. de L'Acad. Imp. Sci., Vol. XIII.
1909. Del Guercio—Redia, Vol. 9, p. 286.
1910. Wilson—Ent. News, Vol. XXI, p. 147.
1911. Wilson—Ann. Ent. Soc. Am., Vol. IV, p. 54.
1919. Wilson—Can. Ent., Vol. LI, p. 18.

NEW COLEOPTERA. VIII.

BY H. C. FALL, TYNGSBORO, MASS.

The receipt of a very distinct new species of Ochthebius from California which it is desirable to make known, affords the opportunity for recording one or two errors in the literature of this genus. Descriptions of a few other new species are added. All types are in the author's collection.

Ochthebius martini, sp. nov.

Form very broad, aeneo-piceous, side margins of elytra explanate throughout and paler in colour. Labrum deeply triangularly emarginate. Prothorax one-third wider than long, widest at anterior third, sides arcuate in basal half, then suddenly deeply sinuate, nearly as in *rectus* (See Horn's figure), transparent border extending from apex to base, becoming very narrow in front of the middle, the sides strongly obliquely convergent from the point of maximum width, feebly arcuate to nearly straight basally; median line deep and entire; discal foveæ rather small and not very conspicuous, well separated, the posterior narrow and about twice the length of the anterior; lateral impressions deep and subparallel sided; surface rather densely, coarsely, evenly punctate, distinctly alutaceous throughout between the punctures. Elytra not more than one-

eighth longer than wide, strial punctures moderately coarse, intervals feebly convex, wider than the striæ on the disk, scarcely so at sides, finely transversely wrinkled. Legs pale, femora more distinctly punctate than usual. Length 2 mm.; width 1.2 mm.

A good series of this very fine species was taken at Redwood Park, California, by my friend Mr. J. O. Martin, to whom it is a pleasure to dedicate the species.

Of our previously described species, *puncticollis* alone possesses an equally broad form, but in it the thorax is much less conspicuously narrowed behind than in *martini*, and the surface is not alutaceous. The terminal joint of the maxillary palpus in the present species is unusually short, not, or only just perceptibly longer than wide, not narrowed apically, the tip broadly arcuato-truncate. In this respect it differs from every other species with which I have compared it, though most nearly approached by *puncticollis*. In this connection it may be remarked that the very unique marine *Ochthebius lapidicolus*, recently described by Van Dyke, has also aberrant maxillary palpi, the terminal joint very small, short and pointed.

O. fossatus Lec. An examination of the type of this species described in 1855 from Ft. Yuma, Cal., shows that it is not the same as *nitidus*, with which it was united by LeConte, but is really identical with the closely allied *tuberculatus* and *foveicollis*, described in 1878, the former from New Mexico, the latter from Florida. Horn correctly united *tuberculatus* and *foveicollis* in his revision of the genus in 1890, choosing to retain the latter name, although *tuberculatus* takes page precedence. Both these names, therefore, fall into synonymy, and *fossatus* must be restored to the List.

O. nitidus Lec. This seems the proper place to say that the drawing of the thorax of this species, Fig. 7, in the plate accompanying Horn's paper shows that the author must have had something entirely different in hand. The thorax in *nitidus* is closely similar to that shown of *foveicollis*, Fig. 2, differing only in the discal foveæ being smaller and more widely separated. The textual description of the thorax harmonizes completely with the plate; in the description of the elytra, however, special mention is made of the unusually smooth apex, which is the most characteristic feature of the true *nitidus*. Whether this latter character was taken from the specimen in hand or was merely transcribed from LeConte is now a question.

Saprinus rugosifrons, sp. nov. (Horn's Group IV).

Rather broadly oval, convex, polished black, the legs dark rufous. Head rather densely substrigosely rugose, marginal stria feebly traceable at sides of the front. Prothorax distinctly less than twice as wide as long, punctures rather closely placed throughout, rather abruptly longitudinally strigose in about the lateral fifth, much finer toward the middle, with coarser punctures along the base, and a few in a vague longitudinal median impression, which is most evident basally. Elytra about one-third wider than long, sides broadly arcuate, more strongly so about the humeri, finely punctate basally, becoming gradually more densely and coarsely so at apex, where the interstitial surface is finely alutaceous. First dorsal stria attaining the apical fourth; second, third and fourth striæ progressively slightly shorter, the fourth arcuately joining the sutural which is slightly abbreviated at apex; oblique humeral well impressed

and almost attaining the internal subhumeral which parallels the posterior half of the first dorsal; external subhumeral entirely distinct from the marginal. Pygidia alutaceous, closely punctate, with a slight tendency toward substrigosity, especially at apex. Prosternum moderately convex at summit, striæ long, parallel, abbreviated in front. First ventral plate concave at middle and with a small tubercle near its posterior margin; last ventral with a transverse flattened tumidity which is obtusely prominent at its lateral limits.

Length (to elytral apex) 3.15 mm. Width 2.6 mm.

Aweme, Manitoba. A single example sent by Mr. Norman Criddle. This species is to be placed near *obscurus* of Horn's Group IV. It is at once separable from any described species of the group by its rugose front and strigose sides of the pronotum. The remarkable ventral modifications are without doubt sexual in nature.

Saprinus castanipennis, sp. nov. (Horn's Group IV).

Broadly oblong-oval, black, elytra castaneous, legs rufous, surface polished throughout. Head finely, rather closely, punctate. Prothorax and elytra punctate over the entire surface, sparsely finely so medially, the punctures becoming much coarser and closer at the sides of the thorax where they are separated by less than their own diameters, also toward the elytral apex where they are of the same size as at the sides of the thorax, but separated on the average by their own diameters. Prothorax a little less than twice as wide as long, sides rather strongly convergent and straight in basal two-thirds. Elytral striæ strong, rather feebly punctate, first attaining the apical fourth, second and third nearly as long, fourth nearly reaching the apical third, strongly arched at base and joining the entire sutural. Pygidia rather densely punctate. Prosternum moderately convex, the striæ parallel and terminating about one-fourth from the apex. Anterior tibiæ multispinulose.

Length 2.3 mm. to the elytral apex, 2.5 mm. over all; width 1.85 mm.

Aweme, Manitoba, 21–VI–1918, (Criddle).

Judging from the description this species is nearest Casey's *laramiensis*, which is, however, a much larger insect (3.–3.4 mm.) with darker legs and with the thoracic punctuation "only slightly closer laterally."

Saprinus iris, sp. nov. (Horn's Group VIII).

Not very broadly oval, polished areas with viridi-aeneo-cupreous lustre, the dull punctured areas bluish, legs dark rufo-piceous. Head smooth, a feeble transverse impressed line above the frontal margin. Prothorax nearly twice as wide as long, sides moderately converging and feebly arcuate, surface not densely strigoso-punctate at sides and in front, leaving a triangular discal polished impunctate area; side margins very narrowly smooth, base with the usual coarse marginal punctures. Elytra rather more than one-fourth wider than long; striæ finely punctate, the first nearly as long as the elytra and curved at its extremity, second three-fourths as long as the elytra, the third and fourth slightly passing the middle; fourth hooked at base, sutural interrupted widely at base in the type, feebly joining the fourth stria in a second specimen; oblique humeral fine and nearly parellel with the first stria; internal subhumeral occupying the middle third of the elytra, with basal appendix nearly joining it to the oblique humeral; external subhumeral not distinct from the marginal; disk rather finely, not densely punctate in somewhat less than apical half, the punc-

tured area finely alutaceous and dull, the impunctate area between the first and fourth striæ also slightly dull owing to an extremely fine, scarcely visible ground sculpture; area between the fourth stria highly polished. Propygidium and pygidium evenly rather closely punctate, the punctures becoming gradually a little smaller toward the pygidial apex. Prosternal lines approximate, gradually convergent anteriorly, becoming subconfluent and evanescent at about the anterior fourth.

Length (to elytral apex) 2.1 mm.; width 1.75 mm.

Described from two examples submitted by Mr. Norman Criddle, who took them at Aweme, Manitoba, V–31–1909 (type) and VII–1–1915. I thought on first sight that these might be small specimens of the rare *seminitens* of LeConte, to which they are certainly allied. On comparing them, however, with the unique type of the latter I find it to be not only much larger, but also a much more coarsely and densely sculptured species with brown bronze surface lustre (not at all bluish) external subhumeral stria distinct from the marginal, the fourth stria joining the sutural and strongly impressed all the way around. None of the more recently described species of Blatchley, Wolcott and Casey agree very closely with the present one.

Telephorus neglectus, sp. nov.

Very similar to *carolinus* with which it is likely to be found mixed in most collections. It may easily be recognized by the following comparative characters.

Neglectus.	*Carolinus.*
Size smaller, averaging 8–9 mm.	Size larger, averaging 9–10 mm.
Antennæ a little shorter, joints 4–10 each, about three times as long as wide.	Antennæ a little longer, joints 4–10, about four times as long as wide.
Front, before the antennæ, broadly infuscate.	Front, before the antennæ more narrowly infuscate at middle
Prothorax more strongly transverse.	Prothorax less strongly transverse.
Claws with a rather strong but acute basal tooth.	Claws "cleft"; the basal tooth long and narrow.

The types (♂, ♀), mounted on one pin, bear labels "Framingham, Mass., V–23–10, C. A. Frost and "Beating oak." Other specimens before me are from Sherborn, Hopkinton and Tyngsboro, Mass., and Berkely, R.I. I am indebted to Mr. Frost for calling my attention to the difference in the claws, which led him to separate his *carolinus* material into two species. The two species are about equally common in Eastern Massachusetts, and it would be interesting to know how widely *neglectus* is dispersed beyond the type region. The form with cleft claws, which is doubtless the true *carolinus*, is quite widely diffused, the material in my own cabinet ranging from New England to Nebraska and North Carolina.

Pedilus parvicollis, sp. nov.

Very elongate; black; prothorax, labrum and front coxæ rufotestaceous; palpi dusky testaceous; legs varying from brown to piceous, the tarsi paler. Head rather small, tempora wanting, eyes large, separated by a distance equal to their own width as viewed from the front; front closely punctate, vertex and occiput sparsely so. Antennæ (♂) strongly flabellate; joint 1 of the usual form, 2 very short, transverse, 3 equal to 1 and 2 united and with a branch slightly shorter than its own length, 4–10 shorter, the outer ones with branches about four times their own length, 11 about as long as the branch of the preceding joint. Prothorax of same width as the head, sides strongly rounded before the middle, oblique and nearly straight posteriorly, surface polished and rather finely sparsely punctate. Elytra nearly parallel, nearly twice as wide and six times as long as the prothorax, less finely and more closely punctate than the latter. Pubescence fine and sparse. Body beneath shining, finely punctate, last ventral segment very broadly obtusely rounded posteriorly. Claws with a small obtuse basal angulation.

Length 6 to 7 mm.

Habitat.—California Sierras.

Described from four males, two of which, including the type, were taken by Mr. G. R. Rilate at Monache Meadows, Tulare Co., 8,000 to 8,300 feet.; the other two by Mr. Hopping at Round Meadow in the Giant Forest region. This species can only be compared with *P. flabellata*, with which alone it agrees in the flabellate male antennæ and in the form of the thorax. In *flabellata*, however, the antennal rami begin on the fourth joint, the third being small and similar to the second, and the prothorax is relatively larger with the sides less strongly rounded than in the present species. The absence of tempora, and the head and thorax of equal width distinguishes *parvicollis* from every other species of our fauna.

GIFT TO THE LIBRARY.

The Rev. Dr. Fyles, of Ottawa, a Life-member and former President of the Entomological Society of Ontario, has most generously presented to the Library a remarkable original work, "as a token of his appreciation of the great pleasure and profit his connection with the Society has afforded him." It is a large folio volume, handsomely bound in leather and entitled, "Illustrations in Natural History." It contains 107 water-colour drawings, chiefly of insects but including a few depicting flowers, birds, reptiles and other animals. The pictures were originally prepared to illustrate popular lectures, and are accordingly of large size and strikingly coloured in order to be visible to the whole of a numerous audience. Many of them were exhibited for this purpose at the annual meetings of the Entomological Society. The volume is a highly-prized addition to our Library, and will serve as a lasting record of the author's artistic skill and devotion to nature in all its aspects. To many also it will bring back memories of delightful addresses by the now venerable author. — C. J. S. Bethune, Librarian.

Mailed September 2nd, 1919.

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POPULAR AND PRACTICAL ENTOMOLOGY.

Collecting Terrestrial Arthropods in Barbados and Antigua, British West Indies.

by DAYTON STONER, IOWA CITY, IOWA.

(Continued from p. 178.)

II. ANTIGUA.

The island of Antigua is situated in latitude 17° 6′ N., and is the principal island of the Leeward group of which it is the political capital. It is roughly oval in outline, twenty-four miles long by about fifteen broad, with an area of 108 square miles and a population of about 36,000. The central part of the island is low and flat and the soil more or less clayey; the southern and southwestern parts, in the vicinity of English Harbour, where a large share of the collecting was done, are volcanic and mountainous and covered, in many places, with dense forests. The greatest elevation is about 1,500 feet. To the north and northeast the soil is composed of calcareous marls and coarse sandstones.

Extended periods of drought often visit the island, and the average annual rainfall is a little less than fifty inches. As a result of the nature of the soil and the protracted dry periods the uncultivated vegetation is largely of a xerophytic nature. However, the soil where it can be worked at all is fertile and retains well the small amount of moisture. Sugar is the principal industry although corn, yams and pineapples are cultivated on a small scale.

Antigua is not under so high a state of cultivation as is Barbados; neither is it so thickly populated as that island; natural enemies of insects are not numerous—all these conditions make for a more abundant and varied insect fauna than we found at Barbados.

The majority of native Antiguans living in the rural districts and small villages are extremely poor, but they are neither so inquisitive nor so insistent on offering their services in collecting specimens as are the Barbadian negroes. This was a great relief to us, and much less trying on our temper and vocabulary.

While the Imperial Department of Agriculture maintains some of its activities on Antigua there is at present no resident entomologist, and we came upon none of the inhabitants of the island who were particularly interested in entomology as a science.

Of the lower forms of terrestrial Arthropods, scorpions and tarantulas, as well as other forms of Arachnids, are abundant. In low-wooded areas, under dried leaves, we found considerable numbers of a large brachypterous cockroach, but in reaching out to seize these agile fellows it was necessary for the collector to look sharply in order to make sure that a scorpion or two did not lurk close enough to be dangerous. Centipedes are not uncommon in moist places.

In addition to the large cockroach above mentioned, two other forms, *Periplaneta australasiæ* and *P. americana* are also very common. A greater

variety of both Acridiids and Locustids was secured here than at Barbados, the large *Schistocerca pallens* being among the former. The Phasmid *Bostra maxwelli* is very common in some portions of the wooded districts.

There are few fresh-water streams and ponds on Antigua. However, one of these ponds, situated about three-fourths of a mile from the Dockyards at English Harbour, was made the object of a rather intensive study. Among the more interesting forms of insect life found here is the mole cricket (*Gryllotalpa* sp.) which we had not discovered at Barbados. The mud shores of the little pond in some places were literally undermined by the tunnels of these peculiar insects. Other groups represented in the pond were Gerrids, Notonectids, Hydrobatids, Belostomids, Hydrophilids and Dytiscids, dragon-fly and damsel-fly larvæ and adults, various species of dipterous larvæ—in fact, the place was found to be a veritable storehouse of interesting entomological material. Of course, such ponds offer excellent breeding places for mosquitoes, and we found great numbers of both larvæ and pupæ. Needless to say, mesquito nets are a part of the furnishings of every well-ordered house on the island.

The low, grassy lands towards the centre of the island furnish a great variety of insects, particularly in Hemiptera and Orthoptera, and collecting with a sweep net was very productive of results in such situations.

At the south end of the island, where most of our collecting was done, many localities are heavily wooded. Small cultivated and semi-cultivated places on both high and low lands offer excellent collecting grounds. In many places highly xerophytic conditions prevail, particularly on the hills in the in the vicinity of English Harbour. Here the soil is very thin, although it is able to support many harsh and spiny plants. On the mud flats near the harbour at the foot of the hills are to be found great numbers of the elusive tiger-beetle *Cicindela trifasciata* var. *tortuosa*. The same white form (*C. suturalis* var. *hebraea*) that we found at Barbados was also discovered on the sand beaches at Half Moon Bay.

In walking through the wooded districts about Antigua the newcomer is at first struck by the great number of what appear to be climbing vines on the trees. Upon closer examination it is discovered that these "vines" are really the covered galleries through which the termites travel from place to place. These tunnels are everywhere, winding about over the trunks and branches of the trees, and usually terminate in a nest of some size either on the ground or in the trees themselves. The termites are usually sightless, and, being averse to the light, construct tunnels when it becomes necessary to cross an open surface. Both the nests and tunnels are made of pellets of chewed wood fastened together with sticky saliva secreted by the insects, and turn grayish after short exposure to the elements. When thoroughly dry the nests are very tough and resistant, being of about the consistency of hard rubber. The galleries are much more fragile

A most interesting and, to the writer, unusual place in which to find insects is in the great epiphytes or air plants locally known as wild pineapples which grow, sometimes in great numbers, on the manchineel and other trees in the wooded districts. Upon carefully removing one of these "pines" from the tree to which it is ordinarily loosely attached and turning it upside down, the collector is often well repaid for his efforts. Spiders, scorpions, beetles and cock-

roaches are sure to be found. The large leaves of this plant form a receptacle for water, and it is not an uncommon occurrence to find mosquitoes, both larvæ and adults, in such situations.

Among the commonest insects on Antigua are cotton-stainers (*Dysdercus* spp.) of which two or three forms occur on the island. Adults were found in copula in late June and early July at which times also nymphs in all stages of development were taken, particularly along the edges of cultivated fields and on low grasses in open places near woods. By preference these bugs feed on the bolls, seeds, leaves and tender shoots of the cotton plants, but when cotton is lacking they will feed upon other related plants. In addition to lessening the vitality of the plant by extracting the juices, cotton-stainers have been found to transmit a fungous disease which has become serious in some of the islands of the West Indies. Indeed, these pests are responsible, in large measure, for the almost complete abandonment of the cotton-growing industry in Antigua. The name stainer arises from the fact that the cotton lint is discoloured by the excrement of the insects and by the fungous disease which gains entrance through the punctures as well as by the crushing of the insects themselves in the gins.

Other kinds of Hemiptera, both Homoptera and Heteroptera, were taken in great numbers from the grasses and bushes in the cultivated and partly cleared areas all over the island. In fact, the hemipterous fauna exceeded that of any other group of insects, both in variety and abundance. One of the principal families of Heteroptera represented is the Pentatomidæ, of which more than fifteen species were taken. Of these, *Solubea pugnax*, *Piezodorus guildinii* and *Euschistus crenator* are perhaps most generally abundant. In favourable localities *Mormidea vosilon* is often abundant on Solanaceæ. Open fields in the central flats yielded great numbers of *Thyanta antiguensis*, and on the low grass within the crumbling walls of Fort Barclay the peculiar *Mecidea longula* was extremely abundant. A colony of the beautiful steel blue and red *Vulsirea nigrorubra* was found on a small tree along a trail leading through the woods.

The cleared spaces in and near the woods offer good collecting grounds for butterflies. On ascending Monks Hill from the south side by one of the numerous trails great numbers of gaily coloured Hesperids, Nymphalids and Lycaenids are to be found in the neighbourhood of the little truck patches.

In the low cultivated fields along the hills great numbers of larvæ and adults of the boll-worm (*Heliothis* sp.) and the cutworm (*Prodenia* spp.) were found, and some injury was being done to various plants, including corn and sweet potatoes. In such places also the familiar *Chrysopa* larvæ and adults are very common. Small Chrysomelids are not uncommon, *Homophata aequinoctialis* and *Chaetocnema* sp. being among them.

Very often moths of different kinds were attracted by the lights in our quarters at night, the most notable of these being several forms of *Protoparce* and a specimen or two of the interesting noctuid, the black witch (*Erebus odora*).

With such a variety of habitats and faunas represented, collecting was indeed a pleasure, and many localities still remained to be investigated at the expiration of our allotted time upon this interesting tropical island. Although one often associates large, striking or bizarre forms of insect life with tropical countries, particularly with tropical islands, such forms are, with few exceptions, lacking on both Barbados and Antigua.

A great mass of material was secured, and as soon as it is put into proper shape for examination will be submitted to specialists for detailed study and report. As might be expected, the Antiguan material is much in excess of that secured at Barbados.

FOUR NEW AFRICAN MEMBRACIDÆ.*

BY W. D. FUNKHOUSER, LEXINGTON, KY.

1. **Anchon gunni,** sp. nov. (Figs. 1 and 2).

Near *A. nodicornis* Germar but lacking the anterior tooth on the angle of the posterior process, and differing in the markings of the pronotum and tegmina.

Slender, black, punctate, sparingly pubescent; densely white tomentose behind suprahumeral horns and on sides of thorax; suprahumeral horns long, broadly foliaceous at tips which are strongly decurved and sharply pointed; posterior process strongly angular at base, depressed at centre, tip just reaching apex of abdomen; scutellum about as long as broad, strongly bidentate at tip; tegmina smoky-hyaline with ferruginous margins; legs and under surface of body brown, tarsi flavous.

Head broader than long, finely punctate, rather densely pubescent with white hairs; base strongly convex, slightly sinuate; eyes prominent, gray-black; ocelli large but not conspicuous, sordid gray, about equidistant from each other and from the eyes and situated about on an imaginary line drawn through centres of eyes; inferior margin of genæ strongly sinuate; clypeus twice as long as wide, black, punctate, pubescent, extending for more than half its length below inferior margins of genæ, tip rounded and weakly pilose.

Pronotum black, finely punctate, rather sparingly pubescent with white or silvery hairs; metopidium perpendicular, somewhat convex, about as broad as high, narrowest at bases of horns; humeral angles very prominent, triangular, acute; median carina strongly percurrent; suprahumeral horns long, narrow at base but broadly foliaceous at tip, practically contiguous at bases, extending upward and outward, the tips flattened, triangular, sharp, and suddenly bent outward and backward; posterior process rising well above scutellum, then bent sharply backward, sloping downward to meet internal angles of tegmina and then following margins of tegmina to a point about as far caudad as the end of the abdomen, tip very sharp and slightly decurved; scutellum about as long as broad, black, punctate, gradually narrowed towards the apex which is strongly bidentate; a dense linear patch of white tomentose pubescence extends backward from the posterior base of each suprahumeral horn over the pronotum and on to the base of the scutellum.

Tegmina long, narrow, smoky-hyaline, much wrinkled; base narrowly brown, punctate and pubescent, internal apical margin tinged with ferruginous; tips pointed; costal margin not marked with brown; five apical and two discoidal cells. Hind wings with three apical cells.

Under surface of body dark brown; sides of mesothorax and metathorax densely white tomentose; hind trochanters not armed with spines; femora and tibiæ brown; tarsi flavous; claws brown.

*Contribution from the Zoological Laboratory of the University of Kentucky.

Length including tegmina 7 mm.; width between tips of suprahumeral horns 5.8 mm.

Type.—Female.

Locality.—Pretoria, South Africa.

Described from a specimen collected by Mr. David Gunn on January 8, 1915. Type in author's collection. I take pleasure in dedicating this species to Mr. Gunn, who has so kindly furnished me with a large number of interesting species of Membracidæ from South Africa.

The genus *Anchon* is apparently well represented in South Africa. Mr. Gunn has sent me specimens of *A. senegalensis* Fairm., collected at the same locality and at the same time as the above.

2. **Anchonoides minutus,** sp. nov. (Figs. 3 and 4).

Small, black, punctate, densely pubescent; suprahumeral horns short and very thick; posterior process raised above scutellum, strongly sinuate but not angulate, extending beyond internal angles of tegmina but not reaching apex of abdomen; scutellum entirely exposed, longer than broad, bidentate; tegmina smoky-hyaline faintly tinged with ferruginous, base brown; under surface of body black; legs dark brown with tibiæ somewhat ferruginous and tarsi flavous.

Head wider than long, black, finely punctate, densely pubescent; much swollen in front; base convex and sinuate; eyes large, prominent, brown; ocelli small, pearly, conspicuous, somewhat protruding, about equidistant from each other and from the eyes and situated about on a line drawn through centres of eyes; inferior margins of genæ sinuate, lobed at margins of clypeus; clypeus longer than wide, extending for half its length below inferior margins of genæ.

Prothorax very dark brown in front, black behind, finely punctate, very densely pubescent with silvery hairs; metopidium higher than wide, narrowest at base of suprahumeral horns, brown on upper two-thirds, black just above head, very roughly sculptured, swollen along central line; median carina percurrent; humeral angles large, prominent, triangular, acute; suprahumeral horns very thick, heavy, short, roughly quadricarinate, extending almost directly outward, about as long as the distance between their bases, tips sharp and decurved; posterior process long, very slender, strongly sinuate, smooth, tricarinate, base raised high above scutellum, tip sharp and decurved, extending beyond internal angles of tegmina but not reaching apex of abdomen; scutellum entirely exposed, a little longer than wide, brown, punctate, densely pubescent, gradually narrowed toward tip which is strongly bidentate; a linear white tomentose patch extending backward over the pronotum from the base of each suprahumeral horn and covering external basal angle of scutellum.

Tegmina smoky-hyaline, wrinkled; a ferruginous spot at internal angle, another at distal end of basal costal cell and a faint fascia at apical margin; base brown, coriaceous and punctate; tip rounded; veins strong, ferruginous, marked with brown in central areas; four apical cells. Hind wings with three apical cells.

Under surface of body black; sides of thorax densely pubescent; margins of abdominal segments ferruginous; coxæ, trochanters and femora dark brown, tibiæ ferruginous and minutely spined, tarsi flavous.

Length including tegmina 5 mm.; width between tips of suprahumeral horns 3 mm.

Type.—Female.

Locality.—Pretoria, South Africa.

Described from a specimen collected by Mr. David Gunn on Nov. 3, 1914. Type in author's collection.

3. **Otinotus pilosus,** sp. nov. (Figs. 5 and 6).

Large, brown, very densely pilose; suprahumeral horns short, heavy, blunt, extending outward and upward and no longer than the distance between their bases; posterior process long, slender, sinuate, impinging on tegmina and extending to a point about half-way between internal angles and apices of tegmina; tegmina hyaline, wrinkled, base narrowly brown; legs and under surface of body uniformly brown.

Head twice as wide as long, subquadrate, dark brown, finely punctate and densely pubescent; base sinuately convex; eyes large, prominent, brown; ocelli large, prominent, glassy, transparent, considerably nearer to each other than to the eyes, and situated about on a line drawn through centres of eyes; inferior margins of genæ rounded; clypeus nearly three times as long as wide, extending for three fourths its length below inferior margins of the genæ, margin adjoining genæ angulate, tip broadly rounded.

Pronotum dark brown, finely punctate, densely pilose with yellowish hairs; metopidium about as broad as high, nearly perpendicular above the head, slightly convex; median carina distinctly percurrent; humeral angles very large, prominent, triangular, blunt, extending almost as far lateral as the suprahumeral horns above them; suprahumeral horns short, heavy, blunt, somewhat compressed dorso-ventrally, strongly tricarinate, extending outward and slightly upward, tips as seen from above roughly truncate; scutellum well exposed on each side, apex yellow, smooth and bidentate, base ferruginous, punctate and densely pilose; posterior process long, slender, sinuate, tricarinate, impinging on tegmina, base not elevated above scutellum, tip acuminate, decurved and black, extending to a point about half-way between internal angle and apex of tegmen but not reaching extremity of abdomen.

Tegmina hyaline, wrinkled; base narrowly brown, coriaceous and punctate; tip pointed; five apical cells. Hind wings with four apical cells.

Legs and under surface of body uniformly dark ferruginous brown; sides of thorax densely white tomentose; tibiæ closely pilose with long, white, bristly hairs.

Length including tegmina 9 mm.; width between tips of suprahumeral horns 4.7 mm.

Type.—Female.

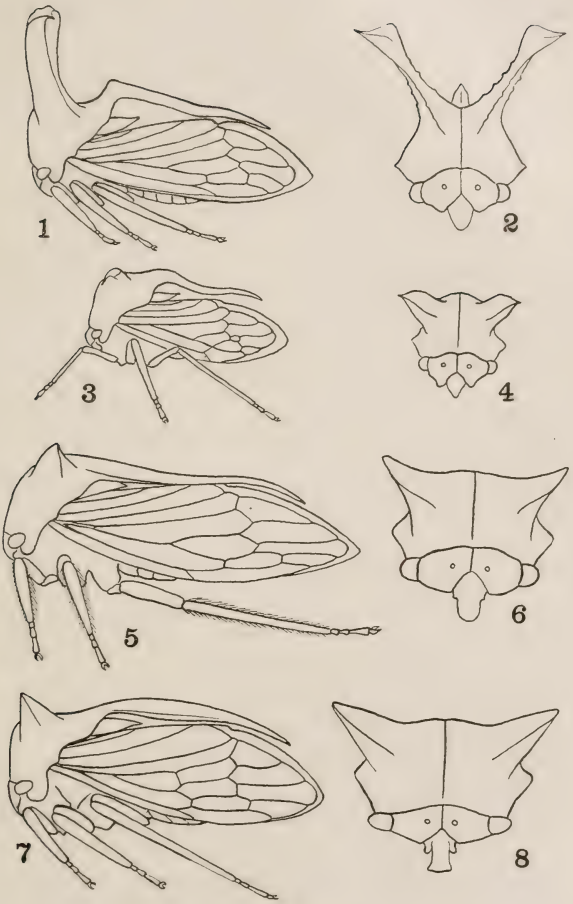
Locality.—Dutch East Africa.

Type in author's collection.

This species is apparently close to *O. nigrorufus* Distant, but differs in colour, in the markings of the tegmina and in the structure of the base of the posterior process.

4. **Otinotus arcuatus,** sp. nov. (Figs. 7 and 8).

Large, robust, ferruginous-brown; suprahumeral horns short, pyramidal, sharply angular, extending outward and upward and about as long as the distance between their bases; posterior process long, heavy, strongly arcuate, the



NEW AFRICAN MEMBRACIDAE.

base slightly raised above the scutellum, tip sharp and extending to a point about midway between internal angles and tips of tegmina; tegmina sordid hyaline, wrinkled, base brown and punctate; legs and under surface of body ferruginous-brown.

Head twice as broad as long, bright reddish brown mottled with black, roughly sculptured, sparingly punctate, sparsely pubescent with silvery hairs; base regularly rounded; eyes large prominent, dark brown; ocelli large, reddish, somewhat protruded, conspicuous, much nearer to each other than to the eyes and situated about on a line drawn through centres of eyes; inferior margins of genæ nearly straight, sloping downward; clypeus nearly three times as long as wide, lobed at angles of genæ, extending for three-fourths its length below margins of genæ, tip swollen and subtruncate.

Pronotum reddish brown, finely and closely punctate, sparingly pubescent with whitish hairs; metopidium broader than high, swollen in centre, perpendicular above the head, a large irregular callosity above internal angle of each eye; median carina strongly percurrent; humeral angles large, prominent, triangular, blunt; suprahumeral horns short, straight, heavy, strongly tricarinate, acute, extending outward and upward, about as long as the distance between their bases; scutellum broadly exposed on each side, brown, punctate, pubescent, gradually narrowed to apex which is smooth, white and bidentate; posterior process long, heavy, strongly arcuate, tricarinate, the base slightly upraised above scutellum, the tip acuminate and extending to a point about midway between internal angles and apices of tegmina, but not nearly reaching extremity of abdomen.

Tegmina hyaline, wrinkled; base brown, coriaceous and punctate; veins prominent and brown; no maculations; five apical cells. Hind wings with four apical cells.

Legs and under surface of body uniformly ferruginous-brown; sides of thorax densely white pubescent.

Length including tegmina 8 mm.; width between tips of suprahumeral horns 5.8 mm.

Type.—Female.

Locality.—Pretoria, South Africa.

Described from two females collected by Mr. David Gunn on January 11, 1915. Type and paratype in author's collection.

The South African species of the genus *Otinotus* bear a strong superficial resemblance to the old genus *Centrotus* (Fabr.), but may be at once separated from the genus by the difference in the number of apical cells of the hind wings.

Explanation of Plate XIX.

Fig. 1. Lateral outline of *Anchon gunni*, sp. nov.
2. Frontal outline of *Anchon gunni*, sp. nov.
3. Lateral outline of *Anchonoides minutus*, sp. nov.
4. Frontal outline of *Anchonoides minutus*, sp. nov.
5. Lateral outline of *Otinotus pilosus*, sp. nov.
6. Frontal outline of *Otinotus pilosus*, sp. nov.
7. Lateral outline of *Otinotus arcuatus*, sp. nov.
8. Frontal outline of *Otinotus arcuatus*, sp. nov.

REPORT ON A SECOND COLLECTION OF NOVA SCOTIAN EUPTERYGID LEAF-HOPPERS, INCLUDING DESCRIPTIONS OF NEW VARIETIES.

BY W. L. MCATEE, WASHINGTON, D.C.

Like a previous collection* sent to the writer by Professor W. H. Brittain, Provincial Entomologist of Nova Scotia, the present is reported upon in print, because it contains undescribed forms. All specimens are in the collection of the Nova Scotia Department of Agriculture.

LIST OF SPECIES.

Alebra albostriella var. *fulveola* Herrich-Schäffer.—Digby Co., N. S., Aug. 14, 1918.

Empoasca atrolabes Gillette.—Digby Co., N.S., Aug. 3, 1918.
" *obtusa* Walsh.— " " " " 15, "
" *pergandei* Gillette.— " " " " 3, "
" *unicolor* " " " " " 15, "

Typhlocyba querci Fitch.

This is a robust *Typhlocyba*, measuring up to 5 mm. in length. The length of vertex in proportion to width of space between inner margins of eyes (synthlipsis) is as 7–8: 14–16. The ground colour usually is pale yellow.

The colour varieties including those hereafter described may be separated by the following key:

A. Elytral markings in the form of small dusky spots.
  B. With spots only in apices of the discal cells of elytra . . . . . var. *querci* Fitch.
  BB. With three pairs of spots along the commissural margin . . . . . var. *6-notata* Van Duzee.
AA. Elytral markings in the form of cross-bands or lengthwise vittæ.
  C. The most conspicuous markings are cross-bands.
    D. Anterior cross-band narrow, directed backward on the sides. (var. *bifasciata* Gillette and Baker now called) . . . . . var. *gillettei* Van Duzee.
    DD. Anterior cross-band broad, directed forward on the sides. . . . . var. *volans*, n. var.
  CC. The most conspicuous markings are lengthwise.
    E. Clavus except extremities and adjacent corium dusky; no posterior cross-band. . . . . var. *grata*, n. var.
    EE. Elytron with a lengthwise streak connecting anterior and posterior cross-bands. . . . . var. *scripta*, n. var.

In the present collection are represented:

Typhlocyba querci var. *querci* Fitch.—Digby Co., N.S., Aug. 3, 1918.

Typhlocyba querci var. *gillettei* Van Duzee.—Digby Co., N.S., Aug. 8, 1918: Victoria, B.C. July 17, 1918.

Typhlocyba querci var. **volans,** new variety.

With two dusky cross-bands, much broader than in variety *gillettei* Van Duzee, the posterior over the cross-veins, the anterior over middle of clavi, sloping forward on the corium parallel to anterior edge of elytron. In var.

*See Can. Ent., Vol. L, No. 11, 1918, pp. 360–361.

gillettei this band is narrower, nearer apices of clavi and slopes obliquely backward, not forward.

One ♀ specimen, Digby Co., N.S., Aug. 18, 1918.

Typhlocyba querci var. **grata,** new variety.

Scutellum dusky; elytra with a large dusky saddle-spot, occupying most of the clavi, and a portion of each adjoining corium; no posterior band or clouding.

One ♀ specimen, Digby Co., N.S., Aug. 14, 1918.

Typhlocyba querci var. **scripta,** new variety.

Scutellum chiefly dusky; elytra with dusky bands at middle and on cross-veins, as in var. *gillettei*, apical cells smoky, and with a longitudinal dusky stripe on clavus and overlying claval suture connected with band over cross-veins. These markings leave the margin anteriorly and the tip posteriorly, of the clavus, of the ground colour.

One ♀ specimen, Digby Co., N.S., Sept. 5, 1918.

Typhlocyba rosæ Linnæus.—Digby Co., N.S., Aug. 3, 5, 8, 13, 15, 1918; Truro, N.S., July 24, 1918; Royal Oak, B.C., Sept. 29, 1917.

Erythroneura obliqua Say.—Acaciaville, N.S., May 16, 17, 1917.

DESCRIPTIONS OF FOUR CATOCALA LARVÆ.

BY R. R. ROWLEY, LOUISIANA, MO.

Among a number of mature Catocala larvæ, taken under the bark of hickory trees in the early part of last summer, a dozen or more proved of unusual interest, one a *lachrymosa*, previously undescribed, another a typical *obscura*, a third and fourth showing the slight differences between the closely related species *retecta* and *flebilis*, while still another gave *judith*, but the description was misplaced.

Other larvæ were of *angusi* and its variety *lucetta*, hardly distinguishable from *habilis*. Of six *angusi* moths, five were var. *lucetta*, only one being a typical *angusi;* a like ratio existing in the woods here between the variety and present form. The species, however, is usually rare.

Catocala flebilis.—Mature larva 2⅛ inches long, leaden gray with lighter tubercles. The mid-dorsal band lighter than the general body colour, constricted at the segment edges, forming a series of spots of chain-link appearance. The spots on the first, second and fifth abdominal segments bordered by a black encircling line (on three sides). A dark cross-band covers the back half of the fifth abdominal segment. A black-cross line behind the eighth abdominal segment. The sublateral line or narrow band is dark or quite black above the spiracles. True and pro-legs general body colour. The lateral line of setæ composed of so few and short bristles as to be hardly noticeable. Head gray, round, with short lateral mouth dash of black.

Ventral colour soiled white with faint red blotches about the row of mid-ventral black spots. Larva taken under bark of *Carya alba* (shag-bark hickory). Cocooned June 15th, and gave imago July 20th.

Catocala retecta.—Mature larva 2¼ inches long, dark leaden brown. A mid-dorsal longitudinal "chain link" like narrow band, a little lighter than the general body colour. Still narrower bands of darker hue bound the mid-dorsal band and, beginning with the second abdominal segment, these bounding bands

are very dark brown, almost black, for three or four segments. No dorsal hump. Lateral setæ very short. Head rounded, mottled gray and brown with a short, lateral black dash. Tubercles whitish. Ventral surface pale with greenish tinge except mid-ventrally where the black spots are set in pink patches, A wavy, longitudinal line or narrow band along the line of lateral setæ is dark or quite black.

Taken under the bark of *Carya alba* (shag-bark hickory). Spun cocoon June 11th, and gave imago July 15th.

Catocala lachrymosa.—Full-grown larva 2½ inches long, very dark brown with a lighter cross-band (irregular) over the first abdominal segment, and a less pronounced one behind the fourth pair of pro-legs. No dorsal hump. Head light gray mottled with darker markings. True and pro-legs dark. Tubercles very dark reddish brown. Lateral fringe of rather long bristles. Head round and full. Ventral surface pinkish, with the characteristic black spots. Larva taken under the bark of *Carya alba* (shag-bark hickory). Began spinning cocoon June 29th, and gave imago August 2nd.

Catocala obscura.—Larva 2½ inches long, leaden gray. with only dash lines No hump, no lateral row of setæ. Head round and streaked as in other hickory larvæ. Tubercles pale yellow or quite white, giving the body a speckled appearance. Ventral side of body white with tinge of green. Central row of black spots. Larva taken in hickory bark but fed through to maturity on pecan (*Carya olivæformis*).

Larva cocooned July 8th, and gave moth August 7th. The imago has white fringe on back wing.

THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Fifty-sixth Annual Meeting of the Society will be held at Ottawa, Ont., on Thursday and Friday, the 6th and 7th of November. All the sessions will be held in the Carnegie Library, (Metcalfe Street). On the evening of November 7th the members and visitors will be the guests of the Officers of the Entomological Branch of the Dominion Department of Agriculture, at a smoker, the place of meeting to be announced later.

Members or visitors having papers which they wish to present will please send the title of the same to the Local Secretary not later than October 18th, and state time required for presentation. It is requested that no paper exceed 20 minutes in length. If a lantern is required this fact should also be stated.

L. Caesar, President, O.A.C., Guelph; A. W. Baker, Secretary, O.A.C., Guelph, Arthur Gibson, Local Secretary, Entomological Branch, Dept. Agric., Ottawa.

Charles W. Leng, Secretary of the New York Entomological Society and Research Associate in the American Museum of Natural History, has been appointed Director of the Museum of the Staten Island Institute of Arts and Sciences. Mr. Leng has been interested in the natural history of Staten Island, where he was born and lives, since boyhood. Entomologists and other naturalists, visiting New York City, can reach the Museum of the Institute by a pleasant half hour's sail across the bay on the Staten Island ferry, and thus inspect the collections in all orders that have been accumulated.

MISCELLANEOUS APHID NOTES 1.

BY JOHN J. DAVIS, WEST LAFAYETTE, INDIANA.

Heteroneura, new genus.

Erected for the species *Aphis setariæ* Thomas, which is herewith designated the type. The genus may be characterized as a typical *Aphis* excepting the venation of the hind wings which have but a single cross-vein (Fig. 26). The filament of antennal segment VI is quite long, being 6 to 8 times the length of the base of this segment. *Heteroneura* is analogous to *Carolinaia* in the venation of the hind wing and bears the same relation to the genus *Aphis* as *Carolinaia* bears to the genus *Rhopalosiphum* (*Siphocoryne*). The late Theo. Pergande recognized this as a distinct genus, and used the name here adopted on his slides of *setariæ*.

Fig. 26.—*Heteroneura setariæ* Thos. Hind wing.

Aphis scotti Sand.[1] is a synonym of *setariæ*. The description of *Aphis prunicoleus* Ashm.[2] is a clear characterization of this species and should be listed as a synonym. *Aphis bituberculata* Wilson [2a] is also a synonym of *setariæ* as determined by a comparison of the types by Wilson.

The writer's collection contains *setariæ* from Florida, Illinois, Indiana, Iowa, Kansas, Louisiana, Missouri, New York, Oklahoma, South Carolina, Texas and Wisconsin and our host records include, in addition to the reported hosts, the following: corn, sugar cane, *Eragrostis* sp., *Sorghastrum nutans*, *Panicum capillare*, *Paspalum dilatatum*, and Bermuda grass (*Cynodon dactylon*).

Aphis heraclella, n. n.

This new name is offered for *Aphis heraclii* Cowen, preoccupied by *Aphis heraclei* Koch.

Aphis rociadæ Ckll.

What is considered the same as Cockerell's *Aphis rociadæ*[3] was found abundant on the flower stalks of *Delphinium tricorne* at Lafayette, Indiana, May 9, 1913. The original description included only the apterous female, but certain characters are so unusual and prominent there appears to be little question as to the identity of our species.

Winged viviparous female: Head, thorax and abdomen very dark brown, apparently black. At base of each cornicle brownish. In some specimens the abdomen is distinctly shining dark brown. Antennæ and eyes black. Legs pale brownish, blackish at apices of femora and tibiæ, and tarsi black. Cornicles moderately dark brown. Wing veins black.

1. Bull. Ga. St. Bd. Ent., No. 17, p. 99, Oct., 1905.
2. Pacific Rural Press, Vol. 22, No. 1, p. 8, July 2, 1881.
2a. Ent. News, Vol. 25, No. 7, p. 298, 1 pl., July, 1914.
3. Trans. Amer. Ent. Soc., Vol. 29, p. 115, 1903. I have since had an opportunity to identify this species with certainty by comparing with the type, kindly loaned by A. C. Baker.

Antennæ reaching to or beyond tip of abdomen; segment III with 4 to 8, usually 5, round sensoria, and segments V and VI with the usual ones; filament of VI quite long, being more than half longer than III and seven times the length of VI base (fig. 2a). Beak reaching almost to coxæ of third pair of legs. Cornicles (fig. 2b) of moderate length, being approximately half the length of antennal segment III, cylindrical, and flaring at the tip. Cauda (fig. 2c) broadly rounded and scarcely visible. Wing veins dark brown, the second branch of discoidal branching about ½ the distance from tip to where first branches.

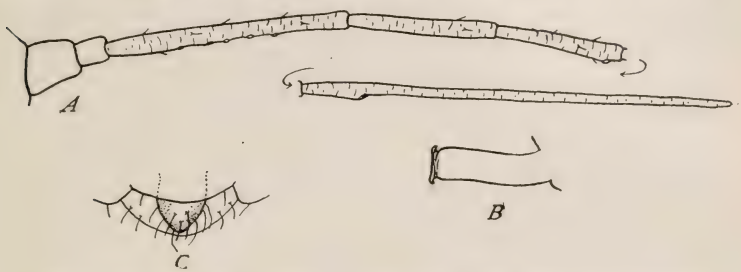


Fig. 27.—*Aphis rociadæ* Ckll. A, antenna; B, cornicle; and C, cauda, of winged viviparous female.

Wingless viviparous female: Entire body very dark shining brown, apparently black, excepting posterior end of abdomen which is of a slightly lighter brown. Antennæ apparently black excepting segment III, which is brownish. Legs as in winged female. Cornicles pale brown and black at tip. Cauda not apparent.

The antennæ similar to those of the winged female, except that they lack sensoria on segment III. Cornicles moderately short and cauda not exposed, but visible as a broadly rounded organ through the transparent body wall when mounted in balsam.

Since writing the above I have received from J. R. Parker sexes of what I believe may be this species, collected in Montana on larkspur. The males are winged and the noticeable differences from the winged viviparous female are as follows: Antennal segment VI, filament longer than III, but not one-half longer; segment III with 60 or 70 small, somewhat tuberculate sensoria, irregularly placed; IV with 12 or 15, and V with 10 similar sensoria; cornicles less prominent, being paler and less conspicuously shaped. The apterous oviparous female differs from the apterous viviparous as follows: Antennal segment VI filament, longer than III but not one-half longer; segment III with 15 to 20 small sensoria, irregularly placed on basal two-thirds; antennal hairs longer; cornicles as in male; and basal third of hind tibia swollen and bearing numbers of small inconspicuous sensoria.

Aphis cuscutæ, n. sp.

This typical aphis which appears to be undescribed, was collected by P. H. Timberlake at Kaysville, Utah, on dodder (*Cuscuta epithymum*) growing on alfalfa. Live specimens were received from Timberlake Oct. 21 and Nov. 10, 1914, from which the following descriptions are made.

It might be noted here that from this live material we reared (*Lysiphlebus*) *Aphidius testaceipes* Cress. (Gahan det.) and a syrphid (*Syrphus opinator* O. S., Aldrich det.).

Winged viviparous female: Head and thorax black, abdomen pale green with three dusky spots on each side anterior to the cornicles and one at the base of the cornicles, an impressed dusky dot on each side of each segment, a brighter green transverse area on each side of the dorsal median line of the segments anterior to the cornicles, a small dusky spot on the dorsal median line of the cornicle-bearing segment, and a similar transverse dusky to blackish marking on the penultimate and last abdominal segments. Antennæ black. Eyes dark reddish brown. Beak black at tips. Legs with femora pale dusky to blackish at tips, tibiæ brown to blackish at tips and tarsi black. Cornicles, cauda, and anal plate black.

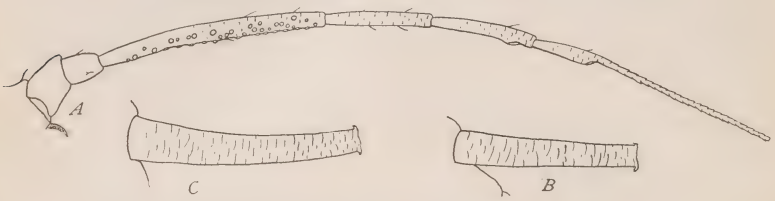


Fig. 28.—*Aphis cuscutæ*, n.sp. A, antenna; B, cornicle, of winged viviparous female; C, cornicle of wingless viviparous female.

Antennæ reaching about to base of cornicles, segments III and filament of IV subequal, the former being slightly the longer, III subequal in length to IV and V combined, segment III with about 40 to 50 circular, slightly tuberculate sensoria scattered irregularly over the surface, and the usual sensoria at distal end of segment V and VI base (fig. 3a). Beak not quite reaching to coxæ of the middle pair of legs. Wings normal, veins narrow, and blackish, the branching of the third discoidal nearer the tip than point where second branches. Cornicles moderately long and reaching just a little beyond tip of body in live specimens (fig. 3b). Cauda typical of the genus, being slender, conical and constricted near the middle. The prothorax with a tubercle which is hidden by the mesothorax in mounted specimens; also a rather prominent tubercle on each side of the first abdominal segment.

Measurements: (Averages) Length of antennal segments III, 0.508; IV, 0.238; V, 0.228; VI, base, 0.122; VI, filament, 0.405 mm.; cornicles 0.379 mm.; cauda, 0.151 mm.

Pupa: Head dusky, thorax pale yellowish green and abdomen marked as in apterous form, but lacking the black markings and bearing a row of rather conspicuous pulverulent spots on each side of the median dorsal line, and the entire body covered with a fine inconspicuous pulverulence. Antennæ dusky to blackish, excepting segment III and base of IV, which are whitish. Eyes dark reddish brown, almost black. Beak not quite reaching coxæ of middle pair of legs. Wing-pads blackish at tips. Legs whitish, the tips of tibiæ and femur and all of the tarsi blackish. Cornicles black and not quite reaching to tip of cauda. Cauda pale with an almost imperceptible duskiness.

Wingless viviparous female: General colour pale green (Smith colour key) and entire body covered with a very thin pulverulence. Head and prothoracic segment dusky to blackish, second thoracic segment dusky on either side of dorsum and a fainter dusky area connecting the two. Abdominal segments

anterior to cornicles with an impressed dusky dot on each side and a brighter green transverse marking on each side of dorsal median line; also marked with a black dot at base of each cornicle and a transverse dusky band on the dorsum of last abdominal segment. Antennæ black excepting basal two-thirds of III which is whitish. Eyes apparently black. Legs with fore pair whitish excepting at joints and the tarsi which are black; middle and hind pair similarly coloured except the femur is dusky to blackish. Beak pale with tip dusky to black. Cornicles black, and cauda pale greenish to blackish,

Antennæ with relative lengths of segments as in winged form, no sensoria excepting the usual distal ones on segments V and VI, base. Prothorax bearing a moderate tubercle near the base on each side. Beak reaching a little beyond coxæ of the second pair of legs. Cornicles moderately long, curved outwards (fig. 3c) and in live specimens reaching beyond tip of cauda. Cauda conical and typical of the genus.

Measurements: (Averages) Length of antennal segment III, 0.486; IV, 0.230; V, 0.226; VI, base, 0.122; VI, filament, 0.452 mm.; cornicles 0. 527 mm.; cauda 0.191 mm.

Cotypes in the collections of the U. S. and Canadian National Museums, and in the writer's collection.

Siphonophora achyrantes Monell.

The type slide (Monell number 125x) of the species described under this name was examined by Monell and the writer in February 1914, and it was

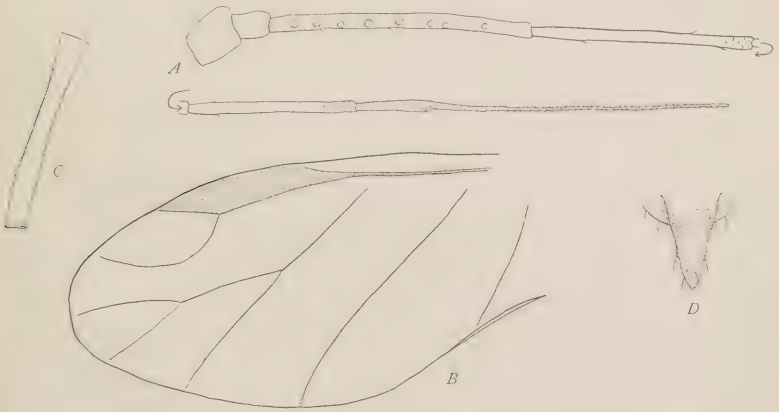


Fig. 29.—"*Siphonophora achyranthes* Monl." A, antenna; B, wing; C, cornicle; and D, cauda, of winged viviparous female. Drawn at St. Louis, Mo., Feb., 1914, from type specimen.

agreed that it was the same as *Myzus persicæ* Sulz. The frontal tubercles and abdominal markings were typical. Other important characters shown in the accompanying drawings (fig. 4) made from the type.

Macrosiphum ribiellum, n. sp.

What is here considered as a new species was originally described by the writer as *Marcosiphum cynosbati* Oestl.[4] Since writing this description the writer has had an opportunity to examine the type of *cynosbati*, and finds it

4. Studies on Aphididæ. Annals Ent. Soc. Amer., Vol. 2, 1909, p. 38, figs.

quite a different species, a typical Myzus. This species will be discussed in a following paragraph.

M. ribiellum (fig. 5) seems to be quite different from any previously described species occurring on *Ribes*. It is not a typical *Macrosiphum* but probably can best be placed in that genus. From other species occurring on *Ribes* it may be separated as follows. The slightly swollen cornicles and fewer sensoria on antennal segment III of the apterous distinguishes it from *Macrosiphum lactucæ* Schr. We are not familiar with *M. ribicola* Kalt., but Theobald gives it as a synonym of *M. lactucæ* Schr. *Rhopalosiphum lactucæ* Kalt. has much greater swollen cornicles which are conspicuously club shaped. Whether *R. sonchi* Oestl. is a synonym of *lactucæ* Kalt. is questionable in my mind. In examining specimens which appear to be typical *sonchi* collected on *Sonchus* and typical *lactucæ* collected on *Ribes*, I can make out no constant character to distinguish the two except that the filament of antennal segment VI in all my *sonchi* specimens is approximately one half longer than segment III, while in

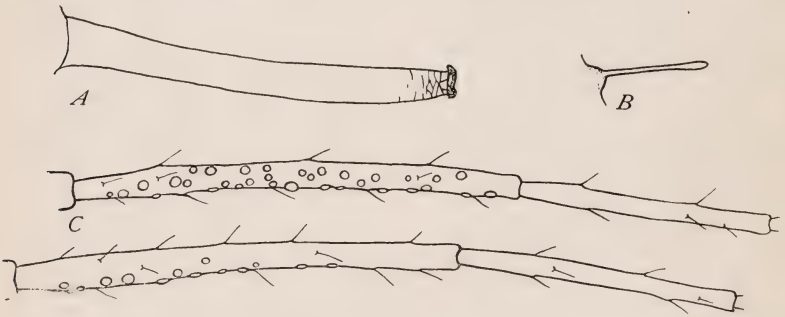
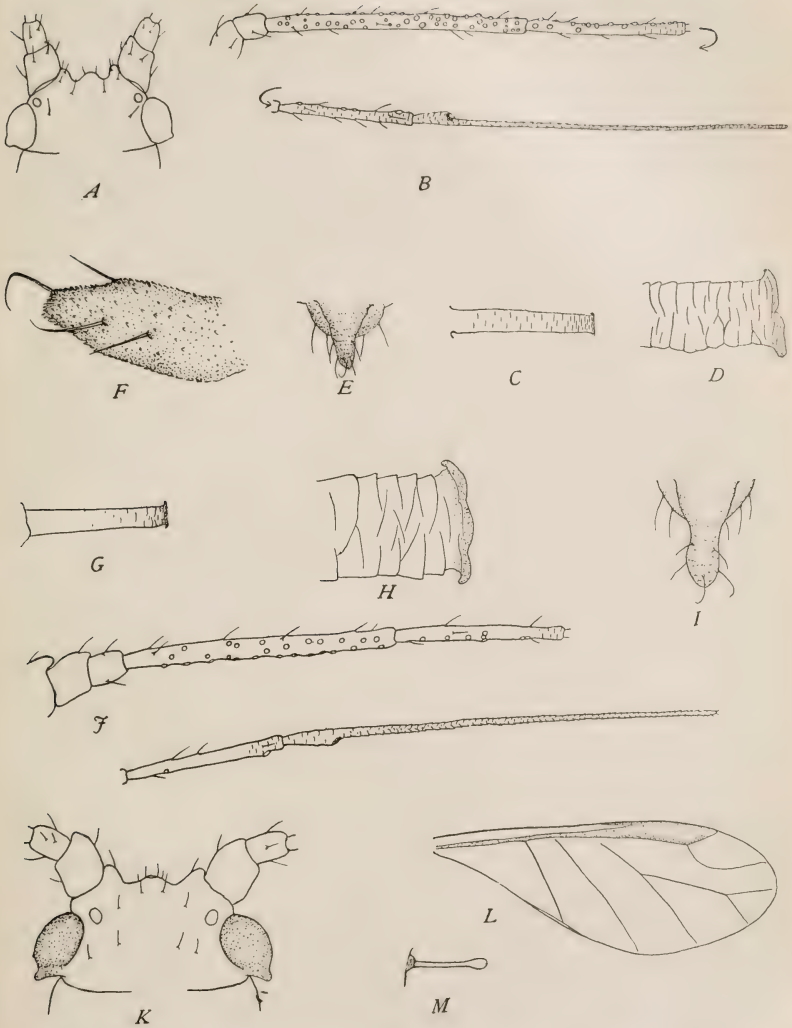


Fig. 30.—*Macrosiphum ribiellum*, n.sp.—A, cornicle of apterous viviparous female; B, antennal hair; C, antennal segments III and IV of winged viviparous female; D, antennal segments III and IV of apterous viviparous female.

lactucæ filament of VI is only very slightly (1/7 to 1/6) longer. *Rhopalosiphum brittenii* Theob. has large swollen cornicles like *lactucæ* which at once separates this species. *Myzus ribis* L. bears numerous sensoria on IV and V, and has very slender cylindrical cornicles which easily separate it from *Macro. ribiellum*. *Myzus whitei* Theob. is separated by the occurrence of a number of sensoria on IV and V, but resembles *ribiellum* in the character of the cornicles. *Myzus dispar* Patch also resembles *ribiellum* in the character of the cornicles, but *dispar* differs by having antennal segment VI filament twice the length of segment III. We have not seen *Rhop. ribesina* v. d. G., but the cornicles are said to be distinctly club-shaped and the antennæ to bear sensoria (10–15) on antennal segment IV. *Myzus cynosbati* Oestl. and *M. houghtonensis* Troop have more sensoria on segment IV and the cornicles are short, cylindrical and typical of many species of the genus *Myzus*. *Aphis* (*Myzus*) *neomexicanus* Ckll. is characterized by antennæ much shorter than body, cylindrical cornicles which do not reach tip of abdomen, and by black markings on abdomen of winged female. *Myzus ribifolii* Davidson is readily separated by the cornicles which are typically Myzus.



Myzus cynosbati Oestl. A, head; B, antenna; C, cornicle; D, tip of cornicle much enlarged; E cauda; F, side view of cauda; much enlarged, of winged viviparous female. Drawn from type specimen in collection of Prof. O. W. Oestlund.

Myzus houghtenensis Troop. G, cornicle; H, tip of cornicle much enlarged; I, cauda; J, antenna; K, head; L, wing; and M, antennal hair, of winged viviparous female. Drawn from type slide 9919a in the collection of The United States National Museum.

Myzus cynosbati Oestl.

As already stated the species described as *cynosbati* by the writer[5] is a different species. The accompanying figures (fig. 6, a–f) were made from the type slide through the kindness of O. W. Oestlund. The type slide is labeled "17/86" and bears dissected winged viviparous female. Antennal segment III bears 50 and 53 sensoria, respectively, (two antennæ on slide) irregularly placed the entire length of segment, segment IV 22–24 sensoria, V with 3 and the usual distal one. One of the wings on the slide is deformed, having the discoidal vein only once branched; the other wing with the second branch noticeably nearer apex than where first branches. Head mounted on side and view of tubercules not obtainable. Cornicles Myzus-like, imbricated at tip, slender and relatively short. Cauda also short as shown in figure 6e. Legs rather long. Sensilla of antennæ slightly swollen at tip but very inconspicuously so.

Myzus cynosbati we have collected on flowering currant (*Ribes aureum*) at Oak Park, Ill., June 23, 1909.

A species closely related which may prove a synonym of *cynosbati* was described by J. Troop as *Aphis houghtonensis*[6]. We have had the opportunity to examine the type slide of *houghtonensis* through the kindness of A. C. Baker. The types differ from the types of *cynosbati* by having fewer sensoria on segments III and IV of the winged female, having 25 to 28 on III and 2 to 7 on IV, while *cynosbati* has 50 to 53 on III and 22 to 24 on IV. Also the antennal sensilla are conspicuously knobbed in *houghtonensis* and only slightly so in *cynosbati*. (See figure 6, g to m). However, we have seen specimens sent us by R. H. Pettit collected on gooseberry which show all variations between the types of these two species. Further study and breeding work seems necessary to settle the question of synonymy in this case.

Myzocallis alnifoliæ Fitch.

The species referred to by the writer under the name *Callipterus alni* Fabr.[7] should be *alnifoliæ* Fitch according to Baker's key[8].

Saltusaphis elongata Baker.

The original description of this aphid was for the oviparous females only[9]. In the writer's collection is a slide of this species bearing a number of apterous viviparous females collected by J. G. Sanders on *Scirpus* sp. at Madison, Wis., July 13, 1912. It readily runs to *elongata* in Baker's key[10] and differs from the oviparous female only slightly as follows: Hind tibia not swollen nor bearing sensoria; antennal measurements, III, 1.34; IV, .65; V, .53; VI, base, .25; VI, filament, .42 mm., the total length noticeably more than that of the body.

5. Annals Ent. Soc. Amer., Vol. 2, 1919, p. 38.
6. Ent. News, Vol 17, No. 2, p. 59–60, 3 figs., Feb., 1906.
7. Jour. Econ. Ent., Vol. 3, p. 416, Oct., 1910.
8. Jour. Econ. Ent., Vol. 10, p. 423, Aug., 1917.
9. Can. Ent., Vol. 49, No. 1, p. 4, Jan., 1917.
10. Loc. cit., p. 2.

NOTES ON ALLOGRAPTA FRACTA O. S. (DIPTERA: SYRPHIDAE).

*BY W. M. DAVIDSON, U. S. BUREAU OF ENTOMOLOGY, SACRAMENTO, CALIFORNIA.

During the spring and early summer of 1918 the writer was stationed in the Imperial Valley of southern California, and was afforded good opportunity to observe the habits of the predaceous fly, *Allograpta fracta* O.S.

Previous to the first settlement and cultivation, some twenty years ago, the Imperial Valley was a flat, almost treeless, dry plain and, therefore, was not a habitat congenial to Syrphidæ, a family most of whose members prefer moist forested localities. In 1918 with several hundred thousand acres under cultivation to grains, corn, alfalfa, cotton and grapes and with canals everywhere a fairly rich syrphid fauna might have been expected. This was not the case, and with three exceptions the writer failed to observe during five months' time other than aphidophagous types and some of these, the species of *Melanostoma*, abundant elsewhere in California were conspicuous by their absence. The three exceptions above mentioned consisted of the species *Mesograpta geminata* Say, *M. marginata* Say, and *Ceria* sp., the last-named breeding in wounds in the trunks and limbs of cottonwood (*Populus fremontii*). From February to July *Allograpta fracta* was without doubt the most abundant species present, and the larvæ were very beneficial, acting as an undoubted check upon the barley and corn aphis (*Aphis maidis* Fitch). So mild was the winter that numbers of adults were observed January 3rd, on the occasion of a visit to the valley. After the middle of February, when the writer took up his duties, until the end of June, when he left the valley, the adult flies were seen nearly every day, often in abundance, about barley and corn fields infested with aphids. The first larva was observed February 19th, and thereafter larvæ and pupæ were to be found at any time first on barley and later on corn. The larvæ were especially beneficial to barley from March 15th to April 30th, at which date most of the grain had ripened, and to corn during May and June. In some fields they were more abundant than in others, and in those in which they especially abounded it was found that about 25% of the infested heads had larvæ working on the aphids. Experiments on the number of aphids a larva could destroy indicated that one could in its life-time eat all the aphids on from three to four heads of grain of average infestation. It therefore appeared that if at any one time larvæ were found to be working in a quarter of the infested heads in a field they might be expected to wipe out in due course between 75% and 100% of the infestation of aphids. In one field of 20 acres examined on a number of occasions, it appeared that *A. fracta* was responsible for an almost total destruction of barley aphids.

Larvæ of *Eupodes volucris* O.S., *Syrphus americanus* Wied., *Allograpta obliqua* Say, and *Catabomba pyrastri* L. were present in the barley and corn fields, but in much smaller numbers than those of *Allograpta fracta*.

In the Los Angeles district of southern California *Allograpta obliqua* is very abundant and *A. fracta* comparatively scarce, whereas in the Imperial Valley the reverse evidently holds true. *Fracta* is common in the San Diego mountains.

In 1918 *fracta* was not bred from any other host than *Aphis maidis*, except that a single larva was taken attacking *Aphis pseudobrassicæ* Davis. *Aphis*

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October, 1919

brassicæ L., *Myzus persicæ* Sulzer and *Macrosiphum pisi* Kalt. colonies were searched frequently, but in vain, for larvæ and pupæ of the syrphid.

Stages and Parasitism.

At El Centro 8 ova of *fracta* deposited March 22nd hatched 4 in two, 4 in three days, and two resultant larvæ pupated after a stage of 11 and 12 days; one individual emerged as an adult fly 8 days after it pupated. Six other individuals varied in the pupal stage from 5 to 12 days in April. From March 22 to April 30 the minimum daily temperatures ranged from 50 to 63 F., and the maximum from 71 to 96 F.; the average daily minimum was 58 F., and the average daily maximum 86 F.

Between the middle of February and the end of April 45 large larvæ and pupæ of *Allograpta* were collected in the field; of these 12 died in the pupal stage, 14 yielded mature *A. fracta*, 1 yielded mature *obliqua*, and 18 yielded parasites. From two of the parasitized puparia several imagoes of *Pachyneuron* issued, and from the other 16 puparia single Ichneumonid adults emerged. Most of the latter were *Eiplazon laetatorius* Fabr., adults of which were commonly observed flying about the fields. The puparia of the parasitized flies turned brown almost immediately after pupation. Within the puparia the parasites developed a little more slowly than the hosts.

DESCRIPTIONS

The egg is white, microscopically sculptured, elongate oval, in length about .85 mm.; in diameter about .25 mm.; deposited by the parent beside a colony of aphids. Eggs observed on barley plants were all placed so that their long axis was aparallel to the long axis of the blade.

At birth the larva is nearly cylindrical, widest at the middle, whitish in colour, the mouth-parts gray. Each segment bears small, fleshy, conical elevations. The posterior respiratory tubes are short, not fused, and divergent; they are whitish, tipped with light brown. The transverse folds of the body are faint. After feeding the colour of the larva during the first instar becomes grayish white, the area about the dorsal vessel pink.

After the first moult the larva measures about 4.5 mm. in length, and 1 mm. in breadth. The green colour which persists until the pupa is about to give forth the imago is now obvious. Each of the fleshy conical elevations of the integument is surmounted by a short pale bristle. The posterior respiratory tubes become lengthened, basally fused mesad, divergent at the apices, twice as long as their combined basal width, pale green tipped with brown. For a few days after the first moult the pink dorsal stripe is apparent, gradually fading away. The fat bodies show through the integument as two narrow whitish stripes running longitudinally one down either side of the narrow dark dorsal vessel.

The full-grown larva is 8 to 9 mm. in length, 2 mm. wide, and about 1.2 mm. in height; elongate oval, somewhat flattened on dorsum, the anterior end drawn out to a point when the insect extends itself; integument finely papillose, transversely wrinkled, the fleshy conical elevations surmounted with pale spines, colour green, with two narrow whitish longitudinal stripes flanking the dorsal vessel, posterior respiratory tubes fused mesad, .5 mm. long, the combined base about .27 mm. wide. The structure of the stigmal plates is very similar to

that of the larva of *Allograpta obliqua* as shown by Metcalf (1)*, except that the anterior interspiracular spine beside the circular plate is much less prominent in *A. fracta* than in *A. obliqua*.

The larva pupates commonly on the plant surface, generally close by the place where it last fed. On blades of barley and corn the pupæ were almost always oriented parallel to the long axis of the blade.

The puparium is green; the two whitish larval stripes apparent for a day or two; as the true pupa inside takes on the black and yellow colour of the adult fly the colour of the puparium changes until all the green vanishes. The anterior face is bulbous, the outline of the dorsum convex, curving downward to the base of the posterior respiratory tubes, not concave anterad of the tubes, the venter is gently concave, sides narrowing posterad. Armature consists in the pale inconspicuous bristles of the larval integment. Length of puparium 5 to 6.5 mm., maximum breadth 2 to 2.3 mm., height 1.7 to 2.1 mm. (7 individuals).

Adult Female.

Oval. Vertex shining black, continued as a broad stripe to base of antennæ, thence as a narrow stripe to, or almost to, mouth cavity, face narrow, pale yellow or white, the light colour coming up on the sides almost to the ocelli, cheeks pale yellow, in front below the eyes a small brownish spot; pile of face short, pale yellow; pile of frons chiefly light-coloured, but some examples have considerable black pile in the middle; profile of face below antennæ gently concave to the base of tubercle; occipital pile silvery, above fulvous. Antennæ reddish yellow; third segment blackish or grayish along the upper edge, oval in shape, but little longer than wide in middle; arista brown, lighter basally.

Thorax shining metallic green, with short fulvous pile; a pale, yellow lateral stripe from humerus to suture, three yellow spots on the pleuræ; scutellum yellow, the extreme anterior corners black, pile light yellow except for a few black hairs on the disc. Wings hyaline, stigma brownish yellow. Legs yellow, posterior femora with a brown ring near apex, posterior tibiæ with brown rings at basal third and before the apex, hind tarsi reddish brown, last three joints brown; pile light-coloured.

Abdomen narrow, oval; first segment metallic black, anterior and lateral margins pale yellow, sometimes almost half the dorsal surface of the segment is yellow; remaining segments with shining black cross-bands, one on anterior, one on posterior margin, the central black part opaque; second segment with a slightly arched yellow cross-band, reaching the sides for its full width, about one-third as wide as the segment, constricted and sometimes interrupted in the centre, in some individuals continued up the sides to the anterior angles of the segment; third segment with a similar cross-band, wider and more conspicuously arched, not constricted, between one-third and one-half as wide as the segment; fourth and fifth segments with two median longitudinal, narrow, yellow stripes, and with two obliquely placed yellow spots, the latter on the fourth segment rarely coming in contact with the central stripes and reaching the lateral margins in their full width about apical fourth of the segment. Pile of abdomen short, except on the sides of the two basal segments; colour light yellow, on the disc black and yellow mixed.

*Figures in parenthesis refer to Literature Cited.

Length 6 to 7 mm.; length of wing 5 to 5.5 mm.

Described from 12 specimens taken in 1918 at El Centro and Alhambra, Cal.

Adult male (after Williston's quotation of Osten Sacken) (2).

". . . Length 7 mm. Face, including the frontal triangle, pale yellow, slightly opalescent, a bluish black stripe extends from the oral edge to the antennæ, forming a semicircle above them. Antennæ reddish, third segment brown along the upper edge, vertex black. Thorax bright metallic green, a pale yellow stripe on each side between the humerus and the root of the wings; ante-scutellar (post-alar) callosity yellowish; scutellum of a saturate yellow, the extreme corners dark; halteres with yellow knobs. First abdominal segment metallic greenish black, its extreme anterior margin only yellow; the rest of the abdomen black, opaque; an interrupted yellow cross-band on the second segment equal to about one-third the segment in breadth; a somewhat broader, slightly arched, and not interrupted yellow cross-band on the third segment; on the fourth, two narrow, parallel, longitudinal lines in the middle and an obliquely placed, large, oval spot on each side of them, yellow; the narrow fifth segment shows a yellow picture, somewhat resembling that of the fourth segment. Legs yellow; tip of tarsi brownish; hind femora with a brown ring before the tip; hind tibiæ with two such rings, one before the middle, the other before the tip; hind tarsi brown, except the under side of the first joint. Wings hyaline; stigma brownish yellow."

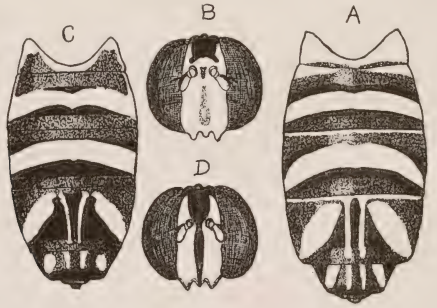

Fig. 31. A, B.—*Allograpta obliqua*, female, dorsum of abdomen and front view of head. C, D.—*Allograpta fracta*, female, dorsum of abdomen and front view of head.

Osten Sacken (3) described the species from a single male collected at Santa Monica, Cal., in 1876. There are before the writer 22 males from southern California; of these 20 have the cross-band of the second segment constricted in the middle and 2 have it interrupted, so that normally this band is not divided as in the type specimen. Also in these 22 males the coloration of the first abdominal segment varies as in the females, some having considerably more than the "extreme anterior margin only" yellow. In the males the cross-band of the third abdominal segment is on the average broader, and the oblique spots of the fourth segment larger than in the females.

Williston (2) indicated the differences between *Allograpta obliqua* and *A. fracta* to consist in the faint brownish facial stripe and yellow first abdominal

segment of the former as compared with the narrow, bluish-black facial stripe and blackish first abdominal segment of the latter.

In the writer's series of both species the facial stripe colour character holds good, although many *obliqua* specimens have the brown stripe hardly "faint" but quite prominent. In the *fracta* series no individual has as much as half the first abdominal segment yellow above, while in the *obliqua* series all specimens have considerably more than half the segment yellow, in fact only the posterior margin is black. The scutellar pile is a good character for separation; in *obliqua* it is all black, and in *fracta* almost all yellow. In both species the picture of the fourth segment is variable, but all the *fracta* females have the longitudinal stripes divergent anteriorly, while all the *obliqua* females have these parallel the whole length. This character does not hold for the males, owing to some of the *fracta* males having stripes not divergent.

A. fracta is a smaller species than *A. obliqua*. The immature stages are virtually indistinguishable.

The only known extra-Californian record for *A. fracta* is that of Metcalf (4) for Blowing Rock, N.C. This record suggests a transcontinental range for the species.

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OBITUARY.

F. H. WOLLEY DOD.

On the 24th July, of enteric, at 49 Hospital, Chanak, Frederic Hova Wolley Dod, of Midnapore, Alberta, Sec. Lieut., Yorkshire Light Infantry, attached Macedonian Labour Corps.

Naturalists are born, not made, and if ever there was an enthusiast—a zealous seeker of scientific truths, it was our good friend who is gone. But to F. H. Wolley Dod even his beloved study of entomology had to take second place in his thoughts after the outbreak of war. He must go, and serve! and handicapped by his years, and his unfitness as a fighting man, he finally overcame all obstacles; obtained a commission; and served as a lieutenant in a Labour Battalion in Macedonia.

His last letter to me was joyous in the Allied victory, and full of plans for the future. "He must set up his Macedonian material, do a little collecting in England for old times sake; and then for Canada, and a trip into the mountains for alpine stuff. Would I go with him?" Aye, gladly would I go!

Dod was the pioneer worker in Alberta on the Ledpidoptera, with a special leaning to the Noctuidæ. For many years he contributed regularly to The Canadian Entomologist, the first of his long series of paper "Preliminary List of

the Macro-lepidoptera of Alberta" appearing in June, 1901. Five or six years ago he again went through his list, publishing additions and corrections. He also published papers in The Entomological News.

His great trait was thoroughness; and a bookcase of his notes on the type specimens, made on the occasions of his periodical visits to South Kensington, etc., not to mention his fine private collection, bear witness to his diligence. In the end he would take nothing for granted; and *believe nothing* unless substantiated by proofs. Nor can he be blamed for his incredulity when his own side of the case was told, viz., the confusion and added difficulties of his work in the early days, due to the snap judgments and incorrect identifications of the specialists of that time. So thoroughness begat real knowledge, and in the end he enjoyed an international reputation as an authority, if not the greatest authority, on the North American Noctuidæ.

A member of a well-known English family, and of excellent education, he loved his Alberta ranch at Midnapore next only to the Empire, and the science to which he devoted his lesiure hours for so many years.

As a scientist leaving an irreparable gap in the ranks, his death could be deplored, and as a friend I could find it in my heart to bitterly begrudge his loss. But neither of these would be worthy nor characteristic of the man—of the sacrifice he so gladly made, and the life he was so ready to give. He, I know, would have but one request to us all: "Continue the good work!"

F. C. W.

Mr. W. Downes, Temporary Assistant at the Dominion Entomological Laboratory, Victoria, B.C., has been appointed a Junior Entomologist and will assist Mr. R. C. Treherne, Entomologist in charge for British Columbia, in the investigations on small fruit insects that are being conducted on Vancouver Island and the Lower Fraser Valley.

Edmund H. Gibson has resigned his position with the U. S. Bureau of Entomology, and is entering upon a new field of endeavor for himself. Believing that entomology can be put on a dignified professional business basis the same as law, medicine, engineering, etc., he is taking the initial step, and believes that after a certain amount of pioneering work the field should open up to other entomologists. Mr. Gibson's headquarters, for the time being, will be Alexandria, Virginia. His professional card is worded "Consulting Entomologist and Agricultural Engineer."

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POPULAR AND PRACTICAL ENTOMOLOGY.

FURTHER REMARKS ON COLLEMBOLA.

BY CHARLES MACNAMARA, ARNPRIOR, ONTARIO.

A very remarkable feature of the Collembola is their amazingly wide distribution. They are found all over the world, and as Dr. Folsom remarks' "may be expected to occur wherever there is a soil that supports vegetation." The one condition fatal to them is dryness. Some of the scaled kinds are said to live in comparatively arid situations, but the vast majority can exist only in a decidedly moist atmosphere. Given a modicum of humidity, however, they can make themselves at home anywhere. You can collect them on cloud-capped mountains, under the dense shade of forests, over grassy plains, along the sea shore, or in your own wood-shed at home. They are perhaps most abundant among the moss, dead leaves, and rotten logs of woodlands, but they are common also in fields, gardens, and green-houses. They shelter under the bark of trees, (I have found them living at the top of a 75-ft. maple)—they are plentiful in long grass and damp soil, and certain over-ripe toadstools often swarm with them. They are counted among the unbidden guests in ants' nests, and one species is known in the United States as a household pest, though admittedly a very minor one. Many frequent caves,—some species occur nowhere else—others find their way deep down into mines, and one ghastly white Isotoma (*I. sepulcralis* Fols.) makes its hideous habitation with mouldering human bodies in the grave. Some occur along the sea shore, and may be submerged by the tide for hours every day without hurt. Others live on the banks of fresh-water streams, and many venture out on to the surface of ponds. A curious accident sometimes happens to these aquatic kinds. The "surface skin" of the water is for them a firm floor which they cannot break through, but occasionally an adventurer among them, by crawling down the stem of a water plant, penetrates beneath the surface. If he returns by the same road, good and well; but if he lets go of the plant, he at once floats up against the under side of the water film, and being as unable to break through from beneath as he was from above, he perishes miserably.

Quite as remarkable as this "sub-ubiquity" of the order is the exceedingly wide range of certain genera and species. The name of the springtails common to the whole Northern Hemisphere is legion; indeed no other order of animals is known to show such a large proportion of Holarctic species. *Isotoma palustris* Mull., to mention only one, abundant on water in this country, is domiciled also in California, Great Britain and Siberia. Other species range even farther. *Sminthurus hortensis* Fitch, which you are sure to find in your garden in May and June if you look for it, is a resident also of Scotland, Bohemia, Japan and Tierra del Fuego. *Achorutes armatus* Nic., plentiful everywhere in our woods, is recorded from Greenland, Spitzbergen, Great Britain, Switzerland, North

Africa, Brazil and Chile, Ceylon, Sumatra, and New Zealand. I once heard a shantyman describing the camp he worked in as being in such an out of the way place in the woods, that even the chickadees had not discovered it. If this man's tastes had been entomological, he would certainly have found that he was not beyond the range of *A. armatus*. The genus Isotoma, however, holds the distributional record. It is not only known all over the globe from the shores of the Arctic Ocean to the remote islands of the Antarctic, but one of its species, *Isotoma klovstadi* Carpenter, shares the honour with another Collembolan, *Gomphiocephalus hodgsoni* Carpenter, of constituting the entire land fauna of the great Antarctic continent. Excluding as essentially pelagic the sea-birds that visit those desolate shores merely to nest, these two tiny and primitive insects are, so far as known, the only indigenous form of terrestrial animal life on Antarctica.

How these delicate, wingless insects have reached such widely separated stations is an interesting question. They are feeble and uncertain travellers, and their dispersal by their own efforts must be very slow. They have, of course, been transported to a certain extent by man along trade routes, but Dr. Folsom regards running water as the chief means of their spread over land areas, and some may be carried for limited distances by ocean currents along coasts and to outlying islands. But this does not explain how they have managed to cross vast ocean spaces and reach far distant and isolated archipelagoes in the Indian Ocean and the Pacific. Their presence in the nests of gulls and puffins on detached rocks on the coast of Ireland, as noticed by Carpenter, indicates the possibility of their transfer in some instances by birds. But the fact, also recorded by Carpenter, that they are plentiful on the ancient granite-formed islands of the Seychelles while nearly absent from the more recent coral islands of the same group, would suggest that their spread by birds must be both slow and limited in extent. It seems most probable that in some cases they have travelled to their present stations by land connections that have since disappeared. It is significant, too, that only the Arthropleona, the more primitive of the two sub-orders, have been found on the Seychelles and Hawaii. Apparently these islands were cut off from the rest of the world before the more specialized Symphypleona had been evolved. The Collembola are of an ancient race, and were old settlers in the world even in the inconceivably far-off days of those strange continents that geologists tell us existed where the oceans are now, and which they map out to the bewilderment of plain people who have been brought up on Mercator's Projection.

Heat and moisture, in some degree, are absolutely essential to all forms of life, vegetable or animal. The Collembola evidently regard moisture as a prime necessity, but many of them are not so particular about heat, and low temperatures affect them less than any other hexapod. This is shown by the habit of numerous species in coming out on the snow—a practice which has earned for them the popular name of "snow-fleas." Like most popular names, the designation is inaccurate, for the Collembola are not in any way related to the true fleas (Siphonaptera) and the species that come out on the snow occur in the summer also. But as the term is convenient to distinguish the insects in their snow-frequenting phase, its use persists.

A considerable number of arthropod sare recorded as having been taken on the snow, including mites and spiders and members of almost every order of insects. The occurrence of a good many of these creatures, however, is purely accidental and involuntary, and is due to their having been evicted in some way from their winter shelters. On the other hand, others come out regularly and with intent, or, if you prefer, as the result of some tropism. But with the doubtful exception of *Isotoma saltans* Ag., reported from the glaciers of the Swiss Alps, no hexapod, so far as I know, makes its permanent habitat on the snow. There are some microscopic rotifers and some curious worms (Oligochæta) that seem actually to live and breed in the snow of glaciers, but the snow-frequenting hexapods merely emerge from the soil and surface detritus for a few hours, more or less, and those that do not perish on or in the snow, eventually retire again to their subnivean shelters. In this class may be mentioned in addition to the Collembola, the Mecopter genus Boreus, and some of the stone-flies, (Plecoptera). I have seen thousands of the latter coming out of the Madawaska River at Arnprior about noon on a fine day in March, and all setting off southwards in obedience to a positive heliotropism that headed them straight into the sunlight. But the best known and most regular frequenters of the snow are certain species of Collembola.

The term "snow-flea" is sometimes used as if it designated a single species. Doubtless the title was first applied to *Achorutes socialis* Uzel, by far the most frequent and abundant species on the snow. But it is necessary nowadays to widen the application of the name; for at least eight genera of Collembola including more than thirty species, have been recorded as appearing on the snow in Europe and North America. Here again, however, we must distinguish between mere chance appearances and regular occurrences. Authors generally have paid little or no attention to this point, but there is no doubt that a good many springtail species appear on the snow, not in the course of a normal life activity, but as the result of an accident. Of the eleven species I have collected on the snow in the vicinity of Arnprior, four had obviously fallen out of logs or been washed from the ground by the running water of a thaw, and the individuals were either dead or numb with cold, although at the same time, the hardier species were quite active on the surface. But even allowing this, the Collembola have still a far larger number of snow species, both actual and proportional, than any other order of insects.

It is remarkable that practically all the snow habitués among the springtails belong to the more primitive of the two sub-orders; the Arthropleona. The only record I can find of a Symphypleona on the snow is given by Schött, who speaks of *Sminthurus aureus* Lubb. as having so occurred in Sweden. But while he mentions no date, the context of his statement leads to the suspicion that the snow fall was an unseasonably early one, and that the creatures were there by accident.

It is also worth noting that, so far as my observations go, none of the white or light-coloured species ever come out in the winter. The snow frequenters are of various shades of blues, browns, yellows, reds, greens and purples, but the colours are all so dark that nearly all the insects look virtually black on the snow. The celebrated Count Rumford, giving practical effect to his studies

in heat and light, dressed in white in the winter, on the principle that, as he was a warm-blooded animal, this costume would reduce to a minimum the radiation of heat from his body. Conversely, the snow-flea being a cold-blooded animal, with no bodily heat to lose, finds its dark pigmentation advantageous in assisting it to absorb heat when it comes to the surface in winter.

A great many species of Collembola survive the northern winter, but the snow-frequenting habit is sharply confined to certain kinds, while other closely allied species never emerge while the snow is on the ground. Available North American and European records credit about one-half of all the snow appearance, accidental or intentional, to the genus Isotoma. The other genera represented are Entomobrya, Achorutes, Onychiurus, Anurophorus, Orchesella, Tomocerus and Sminthurus. My experience in this district also is that Isotoma can claim more species on the snow than any other genus, *Isotoma nigra* MacG. is the most abundant of the genus here, and it is sometimes found over many acres of open woodland or beaver meadow, with a frequency of one or two specimens to the square yard. *I. palustris* Mull., more local in its distribution, often reaches about the same frequency in swampy places. *I. macnamarai* Fols., which affects wet places also, is scarcer, and it usually takes some searching to collect a dozen or so specimens. *I. viridis* Bourl. var. *riparia* Nic. I have found only towards spring. Once I collected 25 or 30 specimens in April on the snow covering a rather dry pasture, but mostly they are found sparingly in woods. A couple of other Isotomas of undetermined species are represented by only a specimen or two, and the appearance of one at least was accidental. Also a few odd specimens of *Tomocerus* sp., *Orchesella* sp. and *Entomobrya* sp. had evidently not come out of their own accord where I found them. Among the real snow travellers, however, we must class *Achorutes armatus* Nic. It never emerges in very large numbers, but I have found it active on the snow in the vicinity of small streams from November to March.

Very seldom do any of the species mentioned so far ever appear on the snow in sufficient numbers to attract the attention of the casual wayfarer; no one but the entomologist who is looking for them is likely to notice them. This does not mean, however, that the insects occur only sparingly, for many people are extraordinarily insensible to phenomena that do not affect them directly, and even when in large numbers, snow-fleas are often passed by unnoticed. One morning, crouched on my snowshoes in a narrow pathway through a cedar swamp, I was picking up Isotomas with a small brush and dropping them into a vial, when I heard another snowshoer come crunching over the crust towards me. It was a labouring man of my acquaintance with his axe on his shoulder, taking a short cut to his work across the Ottawa River. He gave me a polite "good-day," but looked so curiously at my occupation, that in order to preserve at least the remnant of a reputation for sanity, I thought it well to explain to him what I was doing. He was greatly surprised to see the insects on the snow. They were plentiful that morning, and for some distance he had been crushing scores of them under his snowshoes at every step, but he had not noticed them until I pointed them out to him. "Well, by gosh!" he said, "I often heard tell of snow-fleas, but I never seen them before." A worthy man as I know, though imperfectly instructed in grammar.

But the most heedless passer-by cannot overlook *Achorutes socialis* Uzel when it makes up its mind to come out. The vast swarms literally blacken square yards of the snow around the principal foci from which they emerge. On level surfaces they may be as thick as 500 to the square foot, while in hollows and depressions in the snow—such as foot-prints—from which they cannot easily escape, they sometimes accumulate in solid masses that could be ladled out with a spoon. (I find the mark of a No. II shoe-pack an admirable snow-flea trap,—and to prevent unkind inferences I hasten to point out that in winter this footwear calls for at least four pairs of heavy socks.) Spreading out from these centres, the distribution becomes thinner, though for acres the insects often run from 10 to 50 to the square foot, and examination of a yard or so of the surface anywhere over miles of country is almost certain to show two or three specimens leaping and clambering among the snow particles.

Most writers speak of snow-fleas as occurring in the spring, and it is true that some species of them seem to come out only at that season, and in general they are most abundant towards the end of the winter. But it is the effect of the mild weather whenever it occurs and not the season that brings them out, for most of them can be found on the snow every month from November to April whenever the rising temperature approaches the freezing point. Those excellent field-naturalists, the Red Indians, noticed this. Among the native weather lore recorded by F. W. Waugh in his "Iroquois Foods," the snow-fleas are said to indicate mild weather, and the Onondagas, Mr. Waugh says, called them "soft weather fleas."

But it should be borne in mind that while the snow-flea tide rises in direct relation with the temperature, the soft weather is not the determining cause of the insects' emergence. The real factor is the amount of moisture in the atmosphere. In mild weather, the large quantity of water vapor released by the melting snow soon brings the humidity, both relative and absolute, to a high figure, and the snow-fleas, finding a more

(To be continued.)

NEW APHIDS FROM OAKS.

*BY W. M. DAVIDSON, U. S. BUREAU OF ENTOMOLOGY, SACRAMENTO, CALIFORNIA.

Vacuna californica, sp, nov.

Vacuna dryophila Schrank?. Davidson, Journal Econ. Ent., Vol. X, Apr., 1917.

In April, 1917, issue of the Journal of Economic Entomology, the writer referred this species doubtfully to *dryophila* Schrank of Europe, only a single winged individual having been taken up to the time the article (Little-known Western Plant-Lice II) was submitted for publication. Since that time more winged insects have been collected, and all prove to differ from the typical *dryophila* in the same manner as the first. It appears, therefore, that the Californian insect is worthy of specific rank.

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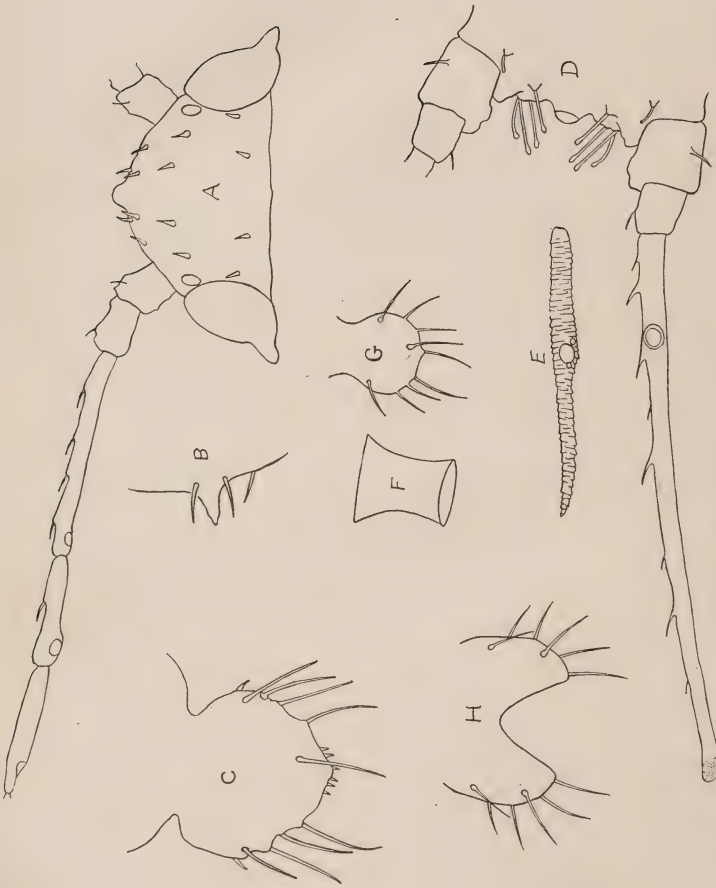

Fig. 32.—A-C, *Vacuna californica*, sp. nov.: A, head and left antenna; B, lateral tubercle of abdomen; C, cauda from above. D-H, *Myzocallis quercifolii*, sp. nov.; D, head and left antenna (joints I to III); E, joint VI of antenna; F, cornicle; G, cauda from above; H, anal plate from above.

The two species differ as follows:—

V. dryophila	*V. californica*
4 or 5 sensoria on antennal III.	Only the apical sensorium on antennal III.
About 9 long hairs on antennal III.	3 or 4 long hairs on antennal III.
Mesothorax appearing as single chitin plate.	Mesothorax appearing as partially divided into lobes.

Dates of collection of winged forms are as follows: May 16, 1915; April 29, 1916; May 8, 1916; *Quercus lobata* Nee, Walnut Creek, Cal., May 14, 1917; *Quercus macrocarpa* Michx., Sacramento, Cal.

Myzocallis quercifolii, sp. nov.

Alate viviparous female.

General colour light green; antennæ pale green with narrow brown annulations at apices of joints, filament of joint VI brownish; head and thoracic lobes olive green; wings hyaline, stigma very pale with dusky brown spots at base and apex; legs pale green, base of tibiæ with a brown ring, femora brownish near apex, tarsi and tibial apices brown; tubercles of thorax and abdomen paler than body colour; cornicles pale green; cauda and anal plate pale green; beak pale, extreme tip brown; venter light green.

Antennæ on short frontal tubercles, slender, longer than body, base and filament of joint VI subequal; joint III with one or two circular sensoria near the base; antennal spines rather stout; the forehead bears 8 stout prominent pale capitate spines, in length equal to half the width of the forehead. Prothorax and mesothorax each with a pair of tubercles on the dorsum. Abdomen narrow, with three pairs of conical tubercles on the dorsum and with three pairs of blunt tubercles on sides. Cornicles slightly longer than wide at base, somewhat constricted in centre. Cauda globular, spinose. Anal plate deeply cleft, spinose. Beak reaches to the second coxæ. Wings longer than body.

Measurements.—Length of body (mounted specimens) about 1.25 mm. Width of body about .45 mm. Antennæ, joint lengths: III .61 mm., IV .35 mm., V .32 mm., VI .28 mm. (.145 mm. plus .135 mm.). Length of wing 1.94 mm., of cornicles .085 mm., of cauda .08 mm., of beak .23 mm., of hind tibia 1.06 mm.

Described from 3 individuals collected on the leaves of Blue Oak (*Quercus douglasii* H. & A.) by Mr. F. B. Herbert, Los Gatos, Cal., June 4, 1917.

This species is closely related to *Myzocallis quercus* Kaltenbach, *M. pasaniæ* Davidson, *M. californicus* Baker, and *M. californicus* Baker var. *pallidus*, below described. The prominent capitate spines on the forehead will distinguish it from others.

The following key will separate the above species:

1. Cornicles partly black.....*Myzocallis quercus* Kalt.
   Cornicles pale throughout.....2.
2. Forehead of winged vivipara with prominent capitate spines.....*Myzocallis quercifolii*, sp. nov.
   Forehead of winged vivipara with spines non-capitate or indistinctly capitate.....3.

3. Distal antennal joint about .58 mm. in length.....*Myzocallis pasaniæ* Davidson.
   Distal antennal joint about .34 mm. in length.....4.
4. Distal sensorium of antennal III at or beyond middle of joint.....*Myzocallis californicus* Baker.
   Distal sensorium of antennal III hardly one-third of the length of the joint from base.....*Myzocallis californicus* Baker var *pallidus* var nov.

Myzocallis californicus Baker var. **pallidus** var. nov.

This form differs from var *californicus* in the sensoriation of the third antennal joint, *pallidus* having 3 or 4 sensoria all in the basal third of the joint, whereas *californicus* has from 4 to 6 sensoria more widely distributed and occupying the basal half or more of the joint The structure of the body including the dorsal tubercles is very similar

Var *pallidus* is pale green in colour, smaller in body than *californicus;* it was collected January 5, 1918, on *Quercus dumosa* Nutt , an evergreen scrub oak, near Jacumba, Cal.

A NEW SPECIES OF THE GENUS TACHYDROMIA FROM ILLINOIS (DIPTERA, EMPIDIDÆ).

BY J. R. MALLOCH, URBANA, ILL.

The type series of the species described herein is deposited in the collection of the Illinois State Natural History Survey.

Tachydromia harti, sp. n.

Male and female.—Glossy dark brown. Head black; antennæ yellowish testaceous; palpi brown. Thorax brown, paler anteriorly; propleura with white pruinescence. Abdomen yellowish at base of venter. Legs yellowish testaceous, darker in female, hind femora and tibiæ except bases, mid tibiæ at bases, and apices of basal three and all of apical two joints of all tarsi in both sexes blackened; fore tibia in male with two deep black spots on the inner or anterior side, one, heart-shaped, beyond middle and the other, round, at apex. Wing with two broad, black fasciæ as in *schwarzi* Coquillett, but the apical fascia extending nearer to apex of wing. Knobs of halteres white.

Eyes distinctly separated in both sexes; third antennal joint not large than second; arista terminal. Dorsum of thorax nude; scutellum with two bristles. Ventral sclerite of abdomen in male in front of hypopygium with a number of curved bristles, apex of hypopygium with a few similar bristles. Fore femur much swollen; fore tibia of male very much dilated from base to apex. Venation as in *schwarzi.*

Length 1.5–2 mm.

Type—male, Havana, Ill., June 5, 1918, (J. R. Malloch). Allotype and paratypes topotypical. One male and three females.

This species is most closely allied to *schwarzi* Coquillett, but may be separated from it by the broadened fore tibia of the male and the very much closer approximation of the subapical fascia to the apex of the wing.

Named in honour of my late colleague, C. A. Hart, who did some of his best work in the locality where the species was taken.

NOTES ON COCCIDÆ—IV. (HEMIPTERA).*

BY G. F. FERRIS, STANFORD UNIVERSITY, CALIFORNIA.

In an earlier paper of this series I called attention to the artificial character of the genus *Sphaerococcus*, and began the process of transferring the included species to other genera. At that time specimens of the genotype, *S. casuarinæ* Maskell, were not available for examination, but since then (through the kindness of Professor Cockerell) I have been enabled to see specimens of this species. The suspicion that I then expressed to the effect that this species is merely an *Antonina* is nearly, if not quite, substantiated, for it is certainly of this type. However, there are certain points upon which the genus *Sphaerococcus* may, for the present, be maintained.

I am here redefining the genus. Also, I am removing from this genus three more species, one of which, *S. obscuratus* Maskell, I refer provisionally to the genus *Kuwanina*, another, *S. leptospermi* Maskell, which I refer to the genus *Amorphococcus*, and another, *S. pirogallis* Maskell, for which I name a new genus, *Eremococcus*. I may note here that *Sphaerococcus sylvestris* Ckll. and King, is probably nothing more than an immature stage of some species of *Kermes*.

Genus Sphaerococcus (Maskell).

Coccidæ referable to the subfamily Dactylopiinæ (of the Fernald Catalogue) and belonging to the *Pseudococcus* group, that is, possessing dorsal ostioles. Adult female resembling the female of *Antonina;* apodous; with the antennæ reduced to mere vestiges of three or four minute segments; with the posterior end of the abdomen invaginated to form a short tube at the inner end of which is the anal ring, this bearing six short setæ. Differing from *Antonina* (if at all) only in the fact that the legs are present in the penultimate stage of the female. First stage larva with six-segmented antennæ, with six hairs on the anal ring, with dorsal ostioles.

Type of the genus, *Sphaerococcus casuarinæ* Maskell. It is probable that none of the other species now referred to this genus are congeneric with the geno-type.

Notes.—As I have pointed out in the description given above, this is essentially an *Antonina*, differing only in the fact that the legs are retained in the penultimate stage. However, this point needs investigation. I would call attention to the fact that in one species now referred to *Antonina* (*A. parrotti* Ckll.) the anterior pair of legs alone are retained in what has been described as the adult. In specimens of *A. indica* Green, the legs are lacking in the penultimate stage.

Sphaerococcus casuarinae (Maskell).

Fig. 33.

There is little except detail to add to the description given by Maskell. The species resembles the various species of *Antonina* except that it is more nearly circular. The anal ring bears six short setæ and is not hairless, as asserted by Maskell. Beyond this the material examined does not permit me to go.

*Continued from Canadian Entomologist, vol. 50, p. 113, (1919).

The first stage larva is quite as in *Antonina*. The antennæ are six-segmented. The anal lobes (Fig. 33) bear a single stout spine, a short seta and the usual long seta.

Material examined. From *Casuarina quadrivalvis*, Australia.

Genus AMORPHOCOCCUS Green.

But two species are at present referred to this genus, one *A. mesuæ* Green, from Ceylon and another *A. acaciæ* Brain, from South Africa. With these

Fig. 33.—*Sphaerococcus casuarinæ* (Maskell); dorsal aspect of portion of caudal extremity of first larval stage.

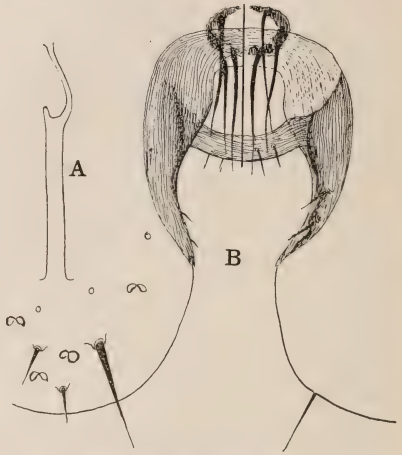

Fig. 34.—*Amorphococcus leptospermi* (Maskell); A, tubular duct; B, anal rings and surrounding structures, left half dorsal, right half ventral.

Sphaerococcus leptospermi Maskell appears to be strictly congeneric. All are gall makers, the galls appearing as twig swellings.

Amorphococcus leptospermi, (Maskell).

Fig. 34.

Habit.—Occurring in a twig gall, this gall being merely a swelling with a small, pore-like opening at the top.

Morphological characteristics.—Adult female apodous and with the antennæ reduced to mere vestiges, which show three or four minute segments. Derm membranous throughout. Pores of the 8-shaped type small and rather few, scattered over the body but most numerous in a narrow zone extending about the lateral margin of the body. Tubular ducts likewise relatively few, of the type shown in Fig. 34A. Anal lobes rather prominent, each bearing one moderately long and two much shorter setæ. Anal ring borne at the inner end of a quite deep cleft, apparently at the end of a short invagination, rather small, bearing six slender setæ. The mouth of the invagination (Fig. 34B) is surrounded by a narrow chitinous ring. From this ring a chitinized area extends posteriorly along each side of the cleft.

Immature stages not seen.

Material Examined.—Specimens from *Leptospermun* sp., Australia, determined by Froggatt at this species and agreeing in general with the original description.

Notes.—Assuming this determination to be correct (as it doubtless is) the original description is in error in the statement that the anal ring is hairless. Also the original description hints at the presence of abdominal spiracles, which are certainly lacking.

This species appears to differ from *A. mesuæ* and *A. acaciæ* in the much deeper anal cleft and the form of the chitinized areas about the anal opening.

Genus KUWANINA Cockerell.

Kuwanina obscurata (Maskell).

Fig. 35.

Habit.—Occurring in galls which are mere swellings of the bark.

Morphological characteristics.—Adult female (Fig. 3A) apodous and with the antennæ reduced to mere vestiges with three or four minute segments. Form broadly oval or subcircular. Derm everywhere heavily chitinized. Anal opening appearing on the ventral side, small, heavily chitinized and only slightly cellular, bearing six very small spines. The opening is covered by a small, cauda-like flap. Constrictions between the abdominal segments very

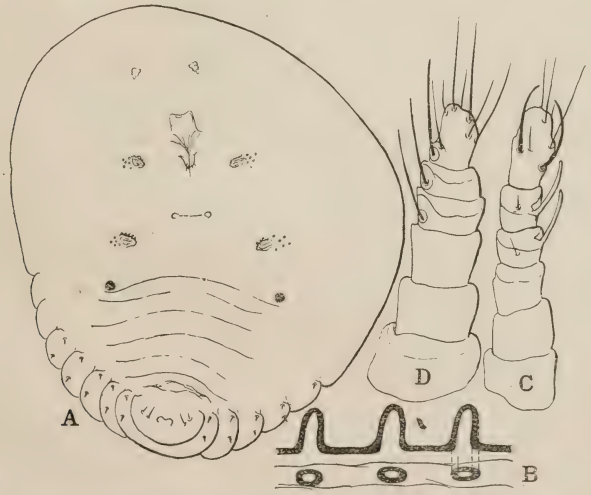

Fig. 35.—*Kuwanina obscurata* (Maskell); A, adult female, venteral aspect; B, pore-like structures of the intersegmental furrows; C, antenna of first stage; D, antenna of penultimate stage.

deep on the dorsal side and extending somewhat to the ventral side. In these constrictions there appear numerous pore-like openings which communicate with invaginations of the derm (Fig. 35B). These invaginations show no evidence of internal pores and are, therefore, hardly to be described as ducts. They are confined to the intersegmental furrows of the abdomen and are most numerous toward the posterior end, forming a continuous, transverse row on the last

four or five segments. Anterior to these segments they appear only toward the lateral margins. Abdomen with a few rather stout, conical spines arranged in transverse rows. Spiracles not unusually large, associated with a few very small, circular pores. Behind each of the posterior pair there is a small, cribriform plate or tubercle.

Penultimate stage.—In form resembling the adult but without the constrictions between the abdominal segments, without the pores in the intersegmental furrows and less heavily chitinized. Antennæ and legs present, the former (Fig. 35C) quite stout, six-segmented, the latter of ordinary character, the tibia somewhat shorter than the tarsus, the claw with a small tooth. Anal ring as in adult but at the tip of the abdomen. Body with a few, scattered conical spines and a very few, small, multilocular pores.

First Stage.—Antennæ (Fig. 35D) six-segmented, the last three segments each with one or two long, stout, curved spines. Anal ring with six slender setæ. Anal lobes each with a single slender seta and two short spines. Derm with a few small, stout spines and multilocular pores.

Specimens examined.—From *Eucalyptus*, New South Wales, Australia. Collected by Koebele and received by me from Mr. Ehrhorn. They agree in all respects with the original description.

Notes.—While it is possible that this species is not strictly congeneric with *K. parvus*, I am inclined to think that it belongs in the group with that species. It will at least rest better in *Kuwanina* than in *Sphaerococcus*. It differs from *K. parvus* in the nature of the first stage and in the entire absence of the tubular ducts which are a conspicuous feature of *K. parvus*, while it agrees in the presence of the pair of cribriform plates or tubercles behind the posterior spiracles.

Genus Eremococcus, new genus.

Coccidæ referable to the subfamily Dactylopiinæ (of the Fernald Catalogue) but of doubtful position within this group. Adult female apodous and with the antennæ reduced to mere unsegmented vestiges; anal orifice simple, minute, borne on the dorsum; dorsum of adult flat, heavily chitinous, venter membranous; mouth-parts with internal framework unusually large and heavily chitinized; first stage larva with anal ring small and simple as in adult, with the antennæ composed of a single very large segment (and possibly one or two minute basal segments), with the anal lobes obsolete and not marked by a long seta. Dorsal ostioles lacking; tubular ducts lacking.

Type of the genus, *Sphaerococcus pirogallis* Maskell.

Notes.—I am unable to throw any light on the relationships of this genus. I would suggest that possibly its nearest relatives are to be sought for in such forms as *Sphaerococcopsis* and *Pseudoripersia*.

Eremococcus pirogallis (Maskell).

Fig. 36.

Habit.—Enclosed within a small, pear-shaped gall which has a minute opening at one side near the base. The insect lies in a saucer-like elevation at the far end of the gall.

Morphological characteristics.—In addition to the characters given in the description of the genus I may add the following. The female of the early adult stage is entirely membranous but at maturity the dorsum becomes heavily

chitinized and the venter becomes much expanded (Fig. 36A). This dorsal, chitinized area is destitute of spines and pores except around its margin where there are numerous slender setæ and pores of the type shown in (Fig. 36B). There are also numerous setæ about the vaginal orifice. The antennæ (or what appear to be the antennæ) are a pair of small, tubular, wrinkled, chitinous structures, usually appearing behind the mouth-parts and presenting no traces of segmentation. The internal framework of the mouth-parts in unusually

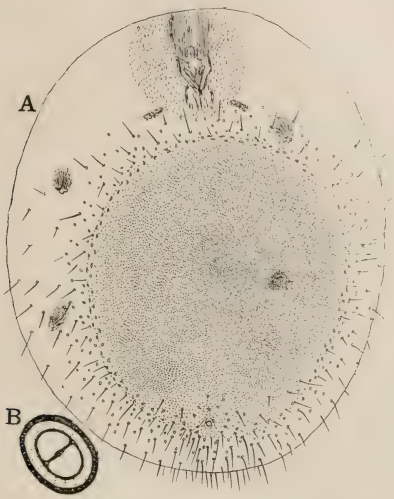

Fig. 36.—*Eremococcus pirogallis* (Maskell); A, adult female, from dorsal aspect; B, type of pore.

large, and the rostrum is borne upon a prominence, the derm of which presents a somewhat papillate appearance. I have been unable to detect any trace of tubular ducts.

The first stage larva is as described under the genus. My material is not in sufficiently good condition to permit the presentation of figures.

Material examined.—Specimens from Froggatt and from Ehrhorn, determined as this species and agreeing with the original description.

WILSONIA—A CORRECTION.

A curious case of lapse of memory occurs in my article, Canadian Entomologist, Vol. LI, p. 212. Although I know several species of *Wilsonia* I used this name for a genus of Aphids. Both Dr. Cockerell and Mr. Criddle have called my attention to it. It is inexcusable. I herewith substitute the name *Dilachnus*.

A. C. Baker.

A NEW OAK GALL FROM ARIZONA. (HYMEN., CYNIPIDÆ).

BY LEWIS H. WELD, EVANSTON, ILL.

Andricus splendens, n. sp.

Female.—Head a clear, dark red, finely shagreened, with whitish hairs on lower face and cheeks, slightly broadened behind the eyes, concave behind. Eyes black, bare, coarsely granulate. Antennæ 14-segmented, the third and fourth slender and equal, the last slightly longer than the next to last, distal half darker. Palpi 5- and 3-segmented. Mesonotum reddish with a median black area enclosing the two anterior parallel lines and a smooth, black area over base of each wing (but sometimes almost uniformly infuscated). It is one and a half times as long as the width of the head, its surface finely coriaceous (best seen in balsam mount) with scattered punctures bearing short whitish hairs. Scutellum is rugose behind with setigerous punctures, has a mediodorsal smoothish area behind the two distinct black polished shallow pits and a steep triangular impression on each side. Mesopleuræ polished, bare except for pubescent area above. Legs lighter in colour, yellowish, with middle and hind coxæ infuscated, hind femur normal, tarsal claws small but in balsam showing a distinct tooth. Wings hyaline with distinct brown veins, surface short brown pubescent and margin short ciliate. Median segment with two distinct outwardly curved ridges enclosing a smooth area which is narrowed at the top. Abdomen darker, smooth and polished, not compressed, as deep as long and with a pubescent area on each side at base. Ventral spine about three times as long as broad, slightly pubescent. Ovipositor (when dissected out) a little longer than length of antenna, eggs well developed, nearly globular with long pedicel. Using the width of head in widest part in balsam mount as a base the length of wing ratio is 4.61-4.78; length of antenna ratio 2.75-2.93; length of ovipositor 2.71–3.00.

Range in length of 350 dry specimens measured by optical methods to nearest tenth of a millimeter was 1.3–2.4mm. Other constants for the group were calculated. Mode 1.950 mm. Mean 1.926–0.007. Median 1.933–0.008. Standard deviation 0.181–0.005. Coefficient of variability 9.40%–0.24%. Average deviation from median 0.147 mm. Quartile deviation 0.127 mm.

Described from two balsam slides, 84 pinned specimens and others in vial dry.

Type and paratypes in U. S. N. M. Type No. 22328. Paratypes deposited also in N. Y. State, American, Cornell, Field and Harvard Museums, and with Wm. Beutenmuller and author.

Related to *Andricus rileyi* Ashm. (to which it runs in the Dalla Torre and Kieffer key in Das Tierreich) which is a larger species from east of the Rockies without a tooth on tarsal claw.

Type Locality.—Prescott, Ariz.

Host.—*Quercus grisea* Lieb.

Gall.—Single or scattered on the under side of leaf. Cylindrical with ends and middle slightly swollen, 2 mm. in diameter and 3–5 mm. high, covered with short stout blunt spines from which run faint decurrent ridges. Sessile, often lop-sided, spines more numerous on basal third. The rosy red colour with a straw yellow band around the middle and some yellow at either end, together

with its crystalline appearance make it a very beautiful object and suggest the name. The basal third is solid, then comes the thin-walled larval cell in the middle of the gall leaving the distal third or more tubular with the open end slightly flaring. The exit hole is made into the hollow portion. The gall was figured by Dr.E.P. Felt in his paper on "Gall Insects in their Relation to Plants" in Sci.Mo. 6:515, Fig. g (June,1918), and again in the Ottawa Naturalist 32:130, Fig. g, and was also characterized by him under the above manuscript name in his "Key to Am. Insect Galls" in Bull. N. Y. State Mus. 200:106.

Habitat.—The species was first brought to my attention by three specimens sent by Dr. Felt, collected by Messrs. Bethel and Hedgcock two miles S.W. of Prescott, Ariz., in the fall of 1917. These were cut open on Dec. 5, 1917, and gave three living adults, one of which was selected as the type. On Apr. 11, 1918, while collecting for the U. S. Bureau of Entomology, Division of Forest Insects, I took galls near Williams, Ariz., on a hillside N.W. of Supai siding, and flies began to emerge before Apr. 16. On Apr. 13, 1918, a lot more were taken near Prescott, and flies emerged by Apr. 20 and continued to come out until the last of May. The larvæ evidently transform to adults in the fall but remain in the galls all winter and emerge the next spring. An alternating sexual generation produced in an early summer gall is suspected but not known.

The U. S. National Museum possesses galls of this species, found on an unknown oak from Durengo, Mexico.

CATORAMA NIGRITULUM Lec.,[1] AND ITS FUNGUS HOST.

BY HARRY B. WEISS, NEW BRUNSWICK, N.J.

This member of the family Ptinidæ was recently found at Springfield and Monmouth Junction, N.J., breeding in the sporophore or fruiting body of *Fomes applanatus*.[2] Smith[3] records it only from Woodbury, July 7 (Brn.) and Blatchley[4] states that it is scarce in Vermillion and Lawrence counties, Indiana, May 24–June 13. Fall in his "Revision of the Ptinidæ of Boreal America"[5] records it as occurring in Mass., D.C., Va., W. Va., Ohio, Mich., Tenn., Miss., Indian Territory and Texas, and writes as follows about the genus Catorama,—"very little is known as yet concerning the life-habits of the species of this genus. Certain species are known to inhabit galls while others have been found in the seeds or stems of various plants."

At Springfield, N.J., on April 8, several specimens of the beetle were taken from the fungus *Fomes applanatus*. More than a month later, or on May 30, numerous adults, several pupæ and many larvæ of all sizes were found in another specimen of the same fungus at Monmouth Junction, N.J. Both the context and tubes of the fungus were bored by the insects, but most of the feeding appeared to have taken place in the tubes. The pupal cells also were found in the tubes.

Fomes applanatus (Pers.) Wallr., occurs on old logs and stumps of deciduous trees in various parts of New Jersey. Overholts in his "Polyporaceæ

1. Kindly identified by Mr. C. W. Leng.
2. Kindly identified by Mr. Erdman West.
3. Insects of New Jersey, N. J. State Museum Report, 1909, p. 307.
4. Coleoptera of Indiana, p. 880.
5. Tr. Am. Ent. Soc., XXXI, 1905, p. 97–296.

of the Middle Western States"[6] records it from Mich., Ohio, Ky., Ind., Ill., Wis., Minn., Iowa, Mo., Kan., Neb., N. Dak. Heald[7] describes a disease of the cottonwood due to *Fomes applanatus*, but Von Schrenk and Spaulding[8] consider it as a saprophytic form.

Full-grown larva.—Length 2.5 mm. to 3 mm. Width 1 mm. Colour whitish or dirty white; body soft, curved, resembling a miniature white-grub, strongly convex above and flattened beneath, skin transversely wrinkled. Head whitish, mouth-parts dark. Body and head sparsely hairy. Median dorsal surface of thoracic segments elevated into a distinct ridge. This ridge not as pronounced in immature larvæ. Dorsal portion of abdominal segments supplied with transverse group of minute stiff hairs or spines. Fewer similar spines on dorsal surfaces of thoracic segments. Legs short and weak.

Pupa.—Length 2.2 mm. Width 1.4 mm. Suboval, white or yellowish white, smooth. Posterior end prolonged into a somewhat flattened blunt process armed at each posterior, lateral edge with a transverse leg-like appendage, each appendage terminated by a chitinous hook.

Adult.—Catorama nigritulum Lec., (Proc. Phil. Acad. Nat. Sci., 1865, 241). The following description is by Blatchley. "Elongate-oval, moderately robust, less than twice as long as wide, not narrowed behind. Black or piceous; pubescence sparse and very fine. Head and thorax finely, closely and evenly punctulate without intermixed coarser punctures. Elytra finely punctulate with scattered larger punctures. Eighth antennal joint broadly triangular. Length 1.7–2.4 mm."

A NEW SPECIES OF PHORIDÆ FROM ILLINOIS (DIPTERA).

BY J. R. MALLOCH, URBANA, ILL.

The species described herein was taken by me in 1918, and the type is deposited in the collection of the Illinois State Natural History Survey.

Beckerina luteola, sp. n.

Female.—Testaceous yellow, shining; third antennal joint orange yellow; frons brownish; dorsum of thorax with 3 faint reddish vittæ; pleura with a small, dark spot below base of wing; dorsum of abdomen except the anterior and posterior margins of each segment brown; apices of hind femora infuscated; wings clear, veins pale brown; halteres yellow.

Frons about 1.5 as broad as long, the surface with sparse, erect setulæ in addition to the strong bristles; preocellar series of bristles almost straight, second series following contour of anterior margin of frons, slightly curved; postantennals two in number, divergent, erect, moderately strong; third antennal joint rounded, about one-fourth as large as eye; arista longer than width of frons, pubescent; palpus larger than third antennal joint, with a few bristles along lower margin; proboscis short, stout, fleshy. Dorsum of thorax with dense, short, pale hairs; scutellum much broader than long, with two bristles; mesopleura bare. Abdomen with a few weak bristles on lateral margins of second and third dorsal segments. Legs stout; fore tarsi slender; all tibiæ

6. Wash. Univ. Studies, Vol. III, Part 1, No. 1.
7. Nebr. Agr. Sta. Rept. 19; p. 92–100, 1906.
8. U. S. Bur. Plant Industry, Bul. 149, p. 58.

rounded, without dorsal setulæ. Costa extending nearly to middle of wing, noticeably thickened from near base to apex, the setulæ rather close, not much longer than diameter of costa, first section slightly longer than 2+3, third about half as long as second; fourth vein arcuate, ending well in front of apex of wing; all thin veins evanescent at apices.

Length 2.25 mm.

Type.—Cobden, Ill., May 9, 1918. One specimen.

This species differs from the only described North American one, *orphnephiloides* Malloch, in being yellow instead of black, in the armature of the frons, and the much shorter costal vein.

A BUTTERFLY NEW TO KANSAS.

BY HORACE GUNTHROP, WASHBURN COLLEGE, TOPEKA, KANS.

The capture of a specimen of *Eresai texana* Edwards in the city of Topeka by Prof. W. A. Harshbarger on October 24, 1918, adds a new species to the list of Kansas butterflies. The specimen, a female, was caught on a hedge on West Sixth St., near the city limits.

According to Holland*, this species ranges from Texas into Mexico, so its presence as far north as Kansas must be looked upon as accidental rather than as an extension of its normal range. It is probable that the chrysalis was carried here upon some shipment of goods on the railroad, or by some other human agency.

PISCATORIAL ENTOMOLOGY.

Entomologists not familiar with the classification of insects more or less current among fly fishermen, may be interested in a brief review of the subject based chiefly on an American book. The classification rests essentially upon the works of various English fly-fishermen but has been applied to American insects, worked out and illustrated in the book to which we refer, namely, "American Trout-Stream Insects," by Louis Rhead (1916).

The names for insects orders which differ most from those in ordinary use among entomologists are: drakes for the may-flies, browns for the stone-flies, duns for the caddis-flies, and spinners for the crane-flies. The nomenclature of species is more or less fanciful, for instance: brown buzz, nobby spinner, yellow sally, black dose. However, names of this sort cannot be entirely ignored by entomologists for among them are some genuine vernacular terms, viz., redbug for *Aphodius fimetarius* in the Catskill region of New York. Since common names for insects are so rare, yet desirable, all those actually in use should be noted.

Fishermen are not to be severely criticized for inventing a classification and nomenclature especially adapted to their special needs, but it should rest upon accurate observation, and reasons urged for adopting it should be the real and perhaps justifiable ones, honestly stated, not unfounded allegations regarding the lack or unreliability of scientific system.

*W. J. Holland. The Butterfly Book. New York, 1904.

The author here reviewed commits all these errors, and his book would have been better without them. As examples of mistakes in observation, we may point out the following: April Insect Chart., Fig. 1. The figure is said to represent one of the Trichoptera, which it illustrates with a caudal appendage having two pairs of branches, something no North American insect of any order has. May Insect Chart, Fig. 14. A crane-fly is drawn with netted venation a character which the artist should have restricted to his browns, duns and drakes, August Insect Chart, Fig. 14. This "fluffy spinner," said to be one of the Diptera, but is drawn with only four legs (all insects having six). The original of this sketch probably was a *Pterophorid* moth. The author speaks a number of times of his faithful representations of the insects and especially of getting the colours true, but to those accustomed to good entomological illustrations, these are crude, and the colours, as reproduced unsatisfactory.

Now, as to reasons for not adopting the classification of scientists Mr. Rhead says: "European entomologists have divided insects into various orders; each season finds them making new classifications so conflicting as to bewilder the lay mind," (p. XVII). Taxonomy has had to bear many reproaches, but this is the first we recall, to the effect that the insect orders are changed each season. Other reasons given by the author for disregarding scientific classifications are expressed in the following sentences: "I was asked by an angling expert who was examining my drawings, "Why don't you give the proper Latin names to each fly?" My answer was, "I would do so, but no entomologist has yet made any effort to classify American trout insects into orders or divisions, families and species as has been done in France and England." (p. 102).

It appears, therefore, that the works of Hagen and of Banks, culminating in the latter's catalogue of the Neuropteroid Insects (1907), which includes all the browns, duns and drakes of Rhead, go for nothing, so far as this author is concerned. Similarly, the works of Osten-Sacken, and of Alexander and the Aldrich Catalogue of Diptera (1905) take care of all of his spinners and other flies, but he knows it not.

Our author makes the remarkable statement also that "Inquiries from various State entomologists failed to locate a single volume or treatise on trout-stream insects" (p. VII). He surely did not inquire of his own State entomologist, for the fact is, that New York State issued long before the date of Rhead's work two very valuable and well illustrated reports on this very subject. These are Needham and Betten's "Aquatic Insects in the Adirondacks" (1901), and "Aquatic Insects in New York State," by Needham, MacGillivray, Johannsen and Davis (1903). The shorter papers bearing more or less on trout stream insects, and publications on kindred topics are numerous.

Another work entitled "Fishing with floating flies" (S. G. Camp, 1913), varies somewhat from the book reviewed in nomenclature of insects, calling the May-flies duns and the caddis-flies sedges. It has the commendable feature, however, of quoting most of its entomological material from a standard work, namely Kellogg's "American Insects" (1905).—W. L. McAtee.

RECENT CANADIAN PUBLICATIONS.

CLASS BOOK OF ECONOMIC ENTOMOLOGY—By Wm. Lochhead, (P. Blakiston's Son & Co., Philadelphia).

This compact book of 436 pages, many of them in reduced type, covers a wider scope of Entomology than any text book we have seen.

Part I (65 pages) deals with the structure, growth and economics of insects, and is of special interest and value, not only because it describes in much more detail than usual the external and internal anatomy—especially the various types of mouth-parts—but also because it brings together in a clear and concise way much valuable data on such interesting subjects as beneficial insects, distribution of insects, insects and disease, and methods of studying insects.

Part II contains tables for the identification of insects injurious to farm, garden and orchard crops, separate tables being made for each host plant. Cross references are also given with each insect to the pages in the latter part of the book where such insect is described in more detail. This enables the student to verify his determinations. Tables of this nature though difficult to construct and seldom satisfactory would appear to be a valuable feature in a book of this nature.

Part III, the main part of the book (280 pages), deals with the classification, description and control of common insects. The old classification has been revised and brought up to date. Each order is treated in considerable detail and keys given not only to the families likely to be met with by the student, but also in many cases to the genera and in a few cases to the most common species. These keys should prove a boon to teacher and student.

Under each family the insects of economic importance are described and an account given of their life-history and the method of control. The total number of insects thus dealt with is large, possibly somewhat larger than necessary.

Towards the end of this part a few pages are assigned to the near relatives of insects, especially such pests as red spiders, sow-bugs, millipedes, slugs and eelworms. Control measures for these are also indicated.

Part IV discusses, in a general way, the control of injurious insects under such subjects as factors of control, cultural or preventive methods, artificial methods, insecticides, spraying, etc.

Although there are 257 illustrations, all of them good and valuable, more would have added to the merits of the book even though this meant an increase in size.

The compilation of a work of this nature, embracing so many aspects of Entomology, must have involved an enormous amount of labour and time, and the author is to be congratulated on the clear, concise way in which he has accomplished his task. The book has many merits and should be of great assistance in furthering the study of Entomology. Its chief defect so far as one can judge without having tested it in the class-room, would appear to be that an attempt has been made to include too many subjects, and while most of these have been well treated, the so-called strictly economic aspect of the work—the life-histories and control measures—have been somewhat sacrificed to the necessity for brevity.

L. CAESAR.

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF NOVA SCOTIA FOR 1918.—No. 4. February, 1919. 89 pp., 7 plates.

In this volume we again have proof of the vigorous condition of our Maritime Branch. It contains 13 papers, many of which are important contributions to Canadian Entomology. Six of these papers deal mainly with the life-histories of particular insects, four with general questions of natural and artificial control, while only one is strictly taxonomic.

The following is a list of these papers:—

A few notes on ant history and habits. By Rev. H. J. Fraser. Pp. 6–9.

The meaning of Natural Control. By John D. Tothill. Pp. 10–14. An analysis of the factors operating in the natural control of Lepidoptera, with special reference to the Forest Tent Caterpillar and the Fall Webworm in New Brunswick. Tables are given, showing the average history of an egg-mass of each of these species during certain years.

Further notes on the Apple Maggot (1918). By W. H. Brittain. Pp. 15–23. In this paper tables are given to show the dates of emergence of 640 adults during the season of 1918, with maximum and minimum temperatures and associated climatic conditions. The time of emergence in early spring is practically the same, whether the season is early or late. Two other tables give dates of emergence according to the variety of apples infested. Experiments were also made to determine the length of the pre-oviposition period, under conditions of control in cages and in the open. It is shown that in certain orchards formerly infested by the apple maggot, but which were rid of the pest by spraying, these insects are now increasing, owing to the orchards having been untreated for two years.

The Salt Marsh Caterpillar (Estigmene acraea Drury). By H. G. Payne. Pp. 24–31. A detailed account of the life-history of this "woolly-bear," with descriptions of all the stages and a table giving dates of hatching, lengths of instars and other data on the seasonal history. The paper is illustrated by an excellent half-tone from a photograph.

A Copper Dust. By G. E. Sanders and A. Kelsall. Pp. 32–37. Gives the results of experiments with a mixture of powdered dehydrated copper sulphate, arsenate of lime and hydrated lime, containing 5 per cent. of metallic copper and 2 per cent. of metallic arsenic. Methods of preparation, storage and cost are also discussed. According to laboratory tests this mixture does not decrease the killing value of arsenicals to the same extent as liquid Bordeaux. Late potato blight was effectively controlled by it.

Notes on the life-history and immature stages of three common Chrysomelids. By W. E. Whitehead. Pp. 38–50. The species discussed are *Disonycha 5-vittata, Chrysomela scalaris* and *Gastroidea polygoni*, all of which are illustrated on plates 2 and 3. Full data on the seasonal history of each is given in tabulated form.

A modified Bordeaux mixture for use in apple spraying. By G. E. Sanders and W. H. Brittain. Pp. 51–61. An extended discussion of the properties and actions of the various formulæ used in the preparation of Bordeaux mixture, particularly with reference to the proportion of lime in its effect on the mixture as a fungicide. Conclusions believed to be correct for Nova Scotian conditions are given on pp. 59–60.

Some notes on Olene vagans B. and McD. in Nova Scotia. By W. H. Brittain and H. G. Payne. Pp. 62–68. Gives a full description of the life-history of this little-known tussock moth, with tables giving duration of stages. These are well illustrated on plate 4, from a photograph.

Some miscellaneous observations on the origin and present use of some insecticides and fungicides. By G. E. Sanders and A. Kelsall. Pp. 69–75. A useful article dealing with the properties and uses of the more important insecticides and fungicides, with particular reference to Nova Scotian practices.

Notes on Lygus campestris Linn. in Nova Scotia. By W. H. Brittain. Pp. 76–81. Discusses the distribution, host plants, injurious habits, life-history and control of this Mirid. The stages are illustrated on plate 5.

Life-History and immature stages of Abbottana clemataria, Smith and Abbott. By H. G. Payne. Pp. 82–85. The various stages are shown on plate 6, from a photograph.

Key for determining the Crambinæ of Nova Scotia. By E. Chesley Allen. Pp. 86–88. The key is based chiefly on the colour-pattern, and the 20 species listed are all illustrated on plate 7 by life-sized figures.

A treehopper new to our list. By W. H. Brittain. P. 89. Gives notes on *Enchenopa binotata* Say, recorded from Nova Scotia for the first time.

The Apple Bud-moths and Their Control in Nova Scotia. By G. E. Sanders and A. G. Dustan. Bull. 16, (Technical Series), Entomological Branch, Dept. of Agriculture. March 1, 1919. 39 pp., 14 figs. in text.

This is a very thorough account of the habits and methods of control of the four commonest and most injurious species of Bud-moths found in the apple orchards of Nova Scotia, viz., the Eye-spotted Bud-moth (*Tmetocera ocellana*), the Oblique-banded Leaf-roller (*Cacoecia rosaceana*), the Lesser Bud-moth (*Recurvaria nanella*) and the Green Bud-moth (*Argyroploce consanguinana*).

The bud-moths are the most serious orchard insects in Nova Scotia, probably causing more injury to apple orchards than all the other insect enemies combined. "It is estimated that in unsprayed or poorly sprayed orchards in Nova Scotia they reduce the crop about 30 per cent. About 75 per cent. of the bud-moths can be destroyed and the crops increased about 22.5 per cent. by two thorough applications of poisoned spray applied before the blossoms open, with a nozzle throwing a coarse driving spray."

"Open planting and thorough pruning help in the control of the bud-moths by allowing the wind to blow away and destroy many of the adults when they are on the wing in June and July."

The Eye-spotted Bud-moth is by far the most important of the four species, over 90 per cent. of the larvæ infesting buds being usually of this species.

Considerable difference exists in the susceptibility of different varieties of apple to bud-moth injury, the varieties having wrinkled twigs being almost invariably more heavily infested than those with smooth twigs, owing to the better hibernating quarters offered by the former to the half-grown larvæ.

Accurate data are given on the injuries to the buds and set of fruit, e. g., the exact reduction in the set as determined by counts of infested blossom clusters in the same variety of apple in the same orchard; the comparative size of the

apples from infested and uninfested clusters; the relation between spring and fall injury, etc.

The control of bud-moths is discussed at length, the measures recommended being based on a long series of experiments on different varieties of apple, using different sprays and nozzles.

The latter part of the paper is taken up with the detailed descriptions, life-history and habits of the four species discussed.

The Fruit Worms of the Apple in Nova Scotia. By G. E. Sanders and A. G. Dustan. Bull. 17 (Technical Series), Entomological Branch, Dept. of Agriculture. March 1, 1919. 28 pp., 9 figs. in text.

The fruit worms discussed in this report are the larvæ of a number of Noctuid moths belonging to the genera Graptolitha, Conistra and Xylena. They are important enemies of the apple in Nova Scotia, and the damage which they effect by eating into the young fruit or the set of the apples causes the dropping of about 72 per cent. of the injured fruit and the deforming of about 78 per cent. of the remainder. The commonest species is *Graptolitha bethunei*.

The life-history of the various species is so similar that a general account is given which applies to all. The moths appear in the autumn, hibernate and deposit their eggs on the twigs of the apple during May. "These eggs hatch about the time the apple buds are beginning to show pink. The larvæ feed for two first two weeks on apple leaves and blossoms, and drop to the ground very readily when disturbed. After the first two weeks the larvæ feed more on the fruit than the leaves, causing an immense amount of injury." Pupation takes place in the ground in early July.

Fruit worms are difficult insects to poison, and their control is largely mechanical. The authors find that an arsenical spray applied immediately before the blossoms is the most valuable, while that applied immediately after the blossoms comes next in importance. The pre-blossom spray should be applied at a high velocity in serious outbreaks.

The latter part of the report consists of descriptions of the earlier stages of the nine species of fruit worms discussed.

A Contribution to the Knowledge of the Bot-flies, Gastrophilus intestinalis, DeG., G. haemorrhoidalis, L., and G. nasalis, L. By S. Hadwen. D.V.S., (Dominion Pathologist, Health of Animals Branch) and A. E. Cameron, M.A., D. Sc., F.E.S. (Technical Assistant, Entomological Branch), Dept. of Agriculture, Ottawa. Bull. Ent. Research, Vol. IX, pt. 2, Sept., 1918.

An investigation into the life-histories and habits of the three species of horse bot-flies that occur in the western provinces. Detailed descriptions are given of the eggs and the manner of their deposition, the young larvæ and their method of entering the host. Experimental evidence is given to show that the eggs of *G. nasalis* and *G. haemorrhoidalis* are capable of hatching spontaneously, and that the larvæ probably penetrate directly into the integument of their host. The eggs of *G. intestinalis*, on the other hand, require moisture

and friction in order to hatch, and the larvæ experimented with failed to enter the skin but succeeded in entering the buccal mucosa.

The distribution of these flies in Canada, the habits of the adults and the period of activity is also discussed.

As a preventive measure against the attacks of *G. haemorrhoidalis* a nose fringe is recommended, consisting of a leather band around the nose and cut into strips long enough to cover the lips of the horse. An additional flap is attached to the band to protect the nose, and a piece of canvas, extending from the nose band to the throat, may be used to ward off attacks of *G. nasalis*.

Some New Species of Tachinidæ From India.—By John D. Tothill. Bull. Ent. Research, Vol. IX, pt. 1, May, 1918. Pp. 47–60, with 16 text figures.

This paper gives descriptions and figures of eight new species of Tachinid flies, which constitute the major part of a collection received from Dr. A. D. Imms. They belong to the genera Gymnochaeta, Servillia (2 species), Gonia, Paraphania, Chaetoplagia, Frontina and Lophosia.

Some Notes on the Natural Control of the Oyster-shell Scale (Lepidosaphes ulmi L.). By John D. Tothill. Bull. Ent. Research, Vol. IX, pt. 3, March, 1919. Pp. 183–196, 7 figs. in text.

This study is based on an examination of about 18,000 egg-masses collected between September, 1916, and April, 1917, from representative places throughout Canada.

It was found that the most important single factor in the control of this scale is the predaceous mite *Hemisarcoptes malus* Shimer, a species of European origin, which feeds upon both the eggs and the growing scales. In some localities, e. g., Moncton, N.B., where the scale has been very abundant, it has been almost exterminated by the mite. In British Columbia, on the other hand, it has not yet been found. "As hundreds of the mites can be sent through the mail on an apple twig it should be possible to colonize it in scale-infested places and countries where it may prove to be absent from the local fauna."

Other important factors in the control of the summer stages of the scale are overcrowding of the scales and the Hymenopterous parasite *Aphelinus mytilaspidis* LeBaron, which in one locality was found to have destroyed 75 per cent. of the scales. E. M. W.

(To be continued.)

CORRECTION (*APHIDIDÆ*).

I am obliged to Dr. A. C. Baker for the information that *Heteroneura*, recently described by the writer in Canadian Entomologist, (1919, page 228) as a new genus to include *Aphis setariæ* Thos., is preoccupied. I am, therefore, proposing a new name, namely, *Hysteroneura*, as a substitute for *Heteroneura*.

John J. Davis.

NOTES ON THE LARCH CASE BEARER (COLEOPHORA LARICELLA HBN.).

BY H. T. FERNALD, AMHERST, MASS.

During the present season (1919)the Larch Case Bearer has made its appearance in Northampton, Mass., apparently at the same place where it appeared in 1886, as recorded by Hagen (Can. Ent., XVIII, 125). A number of good-sized larches have been injured, the outer half of the leaf being thoroughly mined, causing the trees to look quite badly. By the middle of June all work was at an end and no moths could be found, and it is probable that at this time the insect was in the pupa stage.

On July 18th another examination was made, and eggs and newly-hatched larvæ were found in abundance. The egg is rather dome shaped, its diameter at the base being about .3 mm., and its height the same or slightly less. It is of a grayish or brownish colour, apparently determined by the age of the embryo within, the more advanced eggs being darker. The centre of the top is irregularly roughened and about a dozen ridges diverge from this area toward the margin of the egg, the exact number of ridges varying somewhat in different examples. The surface between the ridges is minutely roughened, resembling the surface of an orange. The egg may be placed on either side of the leaf, but most frequently upon the upper one, and somewhere on its outer half.

The larva on hatching appears to enter the leaf, and forms its mine along one edge, working sometimes toward the tip, sometines in the other direction. At this time no trace of a thoracic shield could be found in any of the specimens examined, though quite high power lenses of a compound microscope were used, nor were any prolegs or spines on the body visible, except two or three of the latter on the head and prothorax, so small as to be extremely difficult to locate. The general colour of the larva was brown, but under the microscope appeared mottled with dark reddish. Unfortunately, it was not possible to carry the observations farther.

Mailed Novemober 20th, 1919

The Canadian Entomologist

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POPULAR AND PRACTICAL ENTOMOLOGY.

FURTHER REMARKS ON COLLEMBOLA.

BY CHARLES MACNAMARA, ARNPRIOR, ONTARIO.*

(Continued from page 245.)

and more grateful air, come out in constantly increasing multitudes.

Experiments showed that a temperature of zero Fahrenheit killed *Achorutes socialis* in less than an hour, while at 5° F. they survived indefinitely. But although 5° F. seems to do them no harm, they never expose themselves voluntarily to that degree of cold. The lowest temperature at which I have seen them on the surface was 18° F., and that was very exceptional. As a rule they do not appear until the thermometer approaches 25° F., and from 30° F. upwards they reach their greatest abundance. Their reaction to a rising temperature is rapid. Even when the snow lies two feet deep or more, they are out within an hour or so after the milder weather begins, and after 24 hours of thaw they may be looked for in large numbers. No marked difference in response to temperature changes can be noticed between the various snow frequenters, and usually three or four different species can be found at the same time. In this district *Achorutes socialis* is generally in excess of all the others, but occasionally, for some reason or another, the mild weather fails to attract it, and *Isotoma nigra* or *I. macnamarai* may be the predominant species on the snow.

Outside of temperature, the other weather conditions have little influence on them. Provided the day is mild, they come out as readily in wind, pouring rain or heavy snow as in calm sunshine. During a snow-storm it is interesting to watch how they keep constantly climbing to the surface in order to avoid being buried by the falling flakes.

It is quite possible that sometimes the insects reach the surface by coming up straight through the snow. Their integument is far too delicate for any forceful burrowing, but snow lying loosely as it falls, always has interstices between its particles amply wide enough for the free passage of these minute creatures. This mode of emergence, however, cannot very often be used in mid-winter, for generally the snow stratum, when it attains any thickness, includes one or more layers of crust that are quite impervious to the soft-bodied springtail. Nevertheless, another exit is open to them. Around every stalk of grass, brushwood stem, tree trunk or other object projecting through the snow, there is always a clear space, no matter how deep the snow, resulting partly from the shrinkage of the snow as it settles, and partly from the radiation of absorbed heat by the object. It is from these sally-ports that the snow-flea hosts principally issue.

* We regret the awkward division of Mr. Macnamara's article. Through an unfortunate oversight the concluding sentence of the first part in the November number was left unfinished.

This method of reaching the surface together with other snow habits of the insect were well illustrated in an enormous outbreak of *Achorutes socialis* Uzel that I observed one day in February, and which may be taken as a good example of snow appearances in general. But here, in order to explain how I came on the insects on this occasion, I must make a slight digression.

Achorutes socialis has a strong and distinctive but inconstant smell. I have never seen any reference to it in literature, but Dr. Folsom tells me that he has noticed it both from *A. socialis* and from the closely allied *A. packardi*. It is not easy to describe, but it reminds me most of the smell of that favourite fruit-salad of the small boy: a slice of raw turnip. Sometimes the scent can be caught from half a dozen captives in a vial, at other times a hundred of them give off no appreciable odour whatever. Similarly, during an extensive emergence, sometimes no smell at all can be noticed, and sometimes it is so strong that it is possible to discover an outbreak of the insects by the sense of smell alone. The first time I experienced this I was walking through a hardwood bush one morning in December, and not thinking particularly of springtails, when it suddenly occurred to me that a few moments before I had smelled *Achorutes socialis*. I retraced my steps, and about 50 feet back there they were to one side of my path, coming out of a mossy log in thick, blue-black agglomerations.

It was in the same way that I discovered the insects this day in February. A favourite winter trail of mine at one place goes down the middle of a beaver meadow about half a mile long by 200 yards wide, through which in summer a small, sluggish stream meanders to a sandy bay of the Ottawa River. The meadow is bordered by an open growth of moisture-loving shrubs and trees, such as speckled alders, black and white ashes and soft maples. These occupy a strip a couple of hundred feet wide, and on the drier ground behind, cedars, spruces, hemlocks and pines are mixed with elms and hard maples.

The temperature had been above freezing point for the preceding 24 hours, and three inches of wet snow had fallen in the night, bringing the total depth on the ground up to 18 inches. At noon the thermometer stood at 36° F., the sky was overcast, and the relative humidity was 91 per cent. It was not the kind of day that most people would choose for a snow-shoe tramp for the snow was very wet and the going heavy, but it was ideal snow-flea weather, so I was out bright and early. There was the usual sprinkling of *Isotomas* in the drier woods and *Achorutes* in the damper situations, but I found nothing out of the common until I reached the beaver meadow. Here, while pursuing my accustomed track, as I paused a moment to pick up a specimen, in an instant I caught the familiar smell of *Achorutes socialis*, wind-borne from the south side of the meadow. I followed up the scent and among the ashes and soft maples I found them.

They were coming up to the surface through the spaces in the snow around the trees and shrubs, some climbing the snow wall, and some the trunks and stems. Most of the latter sprang off on to the snow, but a good many remained on the trees, and either gathered in blue patches here and there or went wandering up the trunk, although not to any height, for above 10 feet I could find none. The principal area of emergence was between 50 ft. and 100 ft. wide, and extended all along the south side of the marsh,—a distance of about 800 yards. Over this space there were from 50 to 100 insects to the square foot.

Their movements as usual seemed to lack decision, but the net effect of their apparently purposeless walking and aimless leaping was to spread them out from under the trees in the direction of the light, and they thinned out towards the open meadow into successive bands of approximately 25, 10 and 5 insects to the square foot, until at last in the middle of the marsh only an occasional jumper was to be seen. While the boundary of this edge of the outbreak was indefinite, the other edge, as I had often noticed before in similar cases, ended sharply at the dark evergreens, and not a snow-flea was to be found in the shadows beneath these trees. The insects are evidently possessed of a positive phototropism, although it does not work with the accuracy and directness of the similar tropism of a great many other invertebrates. Another factor in snow-flea distribution is the wind. I once saw the insects blown out on the snow in a long comet tail radiating from the base of an ironwood around which they were emerging during a strong wind, and on this occasion I am sure the fresh southerly breeze aided their spread over the meadow.

By pacing the distances and carefully estimating the average number of insects to the square foot, I calculated that there were not less than 9,000,000 to 10,000,000 *A. socialis* disporting themselves on the snow along this narrow half-mile strip. They were of a well-grown generation, most of them reaching a length of 1.5 mm. with here and there a few 2 mm. individuals, which is the maximum length of the species. *A. socialis* seldom pays any attention to the close approach of the observer, but this day they were more alert than usual, and when I bent to examine a crowded alder stem with my magnifying glass, the occupants all flung themselves off on to the snow, and when, in focusing a wide procession wandering up a tree, I brought my face close to the trunk, a rain of the insects pattered down on my cheek and ear, and the raw turnip smell was very evident.

It was 11 o'clock in the morning when I reached the beaver meadow, and up to 5 p.m. there was no very apparent change in numbers or distribution of the multitude. They kept ceaselessly crawling and leaping, but without seeming to get anywhere in particular. About 5 o'clock, however, a slightly lower temperature set in, and with the first cool breath, the insects began to leave the surface by insinuating themselves between the snow particles, and by 5.30, when I had to leave for home, the numbers visible were noticeably diminished. The temperature was still above freezing, and it was evidently the downward trend and not the absolute degree that drove them to shelter. For although the thermometer registered no lower than 28° F. during the night, and stood at 31° at 9 o'clock next morning—temperatures at which the insects often emerge abundantly—when I got back to the marsh about half past nine, not a single *Achorutes* was to be found on the trees, and 95 per cent. of those on the snow had disappeared, as I ascertained by counting the few individuals remaining on areas I had marked out the day before.

In the course of the next few days I visited the place several times to study the further behaviour of the insects, and my observations may be conveniently summarized as follows:

When the colder and drier weather drives the snow-fleas to shelter, those on the trees and shrubs reach the soil by walking down the way they came up. The insects on the snow, however, show no tendency whatever to go back to

the openings by which they reached the surface, they simply work their way into the snow wherever they may be. Probably when the bed of snow is shallow and soft, they soon get down to the ground, but on this occasion their progress earthwards was decidedly slow. For more than a week after they had left the surface they were still to be found scattered through the snow at various depths. Trenches dug in the snow at several points revealed three crusts—the result of thaws earlier in the winter—each about an inch thick and separated one from the other by from three to seven inches of loose, dry snow. The tiny creatures seemed to have had little trouble in finding passages through the upper crusts, but the bottom crust was solid ice, and here in the first days of my investigations I found the snow-fleas accumulated in considerable numbers. Later on, these insects gradually disappeared. Although lacking any direct evidence, I am of the opinion that by degrees many of them worked their way along through the snow until they encountered some twig or root that pierced the crust and enabled them to crawl down to the earth. There is no doubt, however, that a very large number of the adventurers perish. The fact is that in six years' observation of their winter habits, I have never seen two large emergencies occurring in the same locality, indicates that a great destruction of the insects must take place on every excursion.

After all that has been said about their appearances in the winter, it might be thought that the insects only come out when the ground is covered with snow. The truth is that in favourable weather they emerge just as readily when the ground is bare, but, of course, they do not then attract attention as when they are set off by the vivid background of the snow.

One calm misty morning in that golden prime of spring when the first wild flowers are all out and the mosquitoes aren't, I came down through the woods, leafless as yet, to a marsh that was flooded a couple of feet deep with the high water from the Ottawa River. The whole half mile of swamp, I remember, was ringing from end to end with an astonishing chorus of frogs,—a great volume of sound, but so steady and sustained that presently, like the music of the spheres, it went out of my consciousness, until suddenly I was made aware of it again by the startling abruptness with which it stopped: a marsh hawk sweeping over the water had struck the massed choirs instantaneously dumb. As I worked my way through the alders along the edge of the water, I noticed a good many *A. socialis* climbing in the withered "beaver hay," the blue black colour of the minute insects rendering them conspicuous in the yellow grass As I advanced they became thicker, and here and there strings of them floated down runlets from the woods And then I came on the springtail metropolis. It was a large, moss-covered log so rotten that its species could not be determined, but it was probably a pine. It was bedded on the dead leaves of yester year just at the edge of the water, and from a crevice in its brown crumbling side, *A. socialis* were emerging in solid dark blue masses. The easiest way to appraise them would have been by dry measures. There must have been something over an imperial pint of them visible, and more were continually coming out of the log. On the damp leaves they were gathered into several patches six inches in diameter and fully half an inch thick. I filled a number of collecting tubes chockfull by merely scooping two or three times into these masses. A fine spray of leaping insects played continually over the side of the

log, and the characteristic smell was very apparent. And strange to say, the insects made themselves unexpectedly manifest to another sense also. Rivalling the fairy-tale hero who could hear the grass growing, to my surprise I found I could hear the springtails leaping on the dead leaves. So many hundreds of them were jumping at the same moment, that the myriad simultaneous impacts became audible even to the coarse human sense of hearing, and sounded like the tiny rain we must suppose fell in Lilliput.

Watching any general movement of these insects is like watching the hour hand of a clock. They were evidently spreading out from this focus, but so slowly in spite of all their leaping and crawling hither and thither, that very little change could be noticed during the thirty or forty minutes that I observed them. When I returned to the spot the evening of the following day, they had as usual nearly all disappeared. On the leaves were many white patches of cast skins, and a few stragglers were still crawling over the log, but the millions of yesterday were gone.

These eruptions of *Achorutes socialis* and its congeners are due to overcrowding of the domicile, and in that respect they parallel the swarming of the bees and ants. But there the resemblance stops, for, of course, the springtails have no special organization whatever, and those found living in colonies are merely kept together by a common interest in some food supply or other favourable condition. When the place becomes too small to support them, practically the whole population leaves at the same time, each individual to seek his own private fortune, and the old home is completely abandoned. One obvious advantage of the movement, in addition to a more abundant forage, is the cross-breeding that takes place between different colonies. The increased vigour of the race which accrues no doubt more than counterbalances the large mortality among the emigrants.

The Collembola as an order have never attracted many students, and it is not likely that this article will do anything to increase the number, but "should one heart throb higher at its sway," it would be a pity not to encourage the aspirant to springtail lore, and so I will say something about collecting methods.

The Collembolist's collecting outfit is simple, inexpensive and not at all bulky, but as the insects are found in a variety of situations, several different pieces of apparatus are necessary to capture them. Among the first requisites are the small straight-sided bottles without shoulder or lip, known as shell vials. For general use in collecting and for storage purposes, round-bottomed shell vials about 50 mm. long by 10 mm. in diameter, as recommended by Dr. J. W. Folsom, are best. But for very minute specimens even smaller bottles than these are often desirable, and I usually carry a few vials 40 mm. and 25 mm. long by 6 mm. or 7 mm. in diameter. If not obtainable from stock, any dealer will have such bottles as these made to order at a small cost per gross.

In summer a small fragment of damp, rotten wood or a piece of a moist, dead leaf tamped down into the bottom of the vial will keep the specimen from dying of aridity until you get them home. In winter, when everything outdoors is dried up by the frost, my bottles are furnished with a scrap of filter paper, which can be moistened when required by dropping a granule or two of snow on to it. But one must be careful not to get the bottles too wet inside, or the insects will drown in the water film.

The Collembola, being all very soft-bodied, must be handled with great delicacy to avoid injuring them. The best implement for the purpose is the fine red sable brush used for oil painting, American size No. 1, (English size 00 or 0), preferably of the round shape, but the flat will do. The long handles may be cut down to a length of three or four inches convenient for the pocket or vial case. In a pinch an emergency brush can be made by chewing the end of a small succulent twig into fibres.

A great many Collembolans live under the bark of more or less rotten logs and stumps, and when collecting in this habitat a large pocket knife is very useful to separate the layers of bark. Also the student, unless he has exceptional eyesight, will find a watchmaker's glass necessary to discover the smaller specimens. A glass of two and a half inch or at most two inch focus is strong enough. Any higher magnification leaves too small a working distance. To prevent dewing of the glass in cool weather, two or three holes of about 4 mm. diameter should be bored through the mounting.

As any small object dropped into forest litter or long grass is very hard to find, I tie the collecting brush and the watchmaker's glass at either end of a fine string about 18 inches long This insures their safety, leaves the hands free, and enables the brush to be found without taking the eye off the quarry. Of course, like every other good thing, the arrangement has its drawbacks. But when the cord catches on some obstruction just as a particularly fine specimen has been sighted, and the glass is jerked out of the collector's eye, curses both loud and deep will be found to afford considerable relief to many temperments.

The very ingenious collector devised by Berlese is an admirable instrument for automatically extracting springtails and other small creatures from the debris of forests and such like materials But for adequate results the apparatus must be employed on a larger scale than is possible for an amateur without any special laboratory. And so, while I have used a small Berlese collector with some success, I prefer to sift for the insects in the open. My sieve consists of a wooden hoop 12 inches in diameter and one inch deep, to which is attached a sleeve of ticking about 10 inches long, while the netting is wire cloth of 12 meshes to the inch. A black silk handkerchief and a white linen one complete the outfit. In practice, one sits down in a likely place, puts a couple of handfuls of dead leaves into the sieve and shakes it over the handkerchief spread on the knees. Then by means of the brush, the dislodged Collembolans are transferred to a vial. Changing occasionally from the black to the white handkerchief, or vice versa, often reveals many minute and unsuspected insects of the contrasting hue.

For springtails of a different milieu a very useful device is a tin funnel 3½ inches or 4 inches in diameter at the mouth, such as can be bought at any hardware store for a few cents. A fair-sized, straight-sided bottle is corked to the tip of the funnel, and the implement is used to sweep herbage, the surface of pools, wet sand and similar formations. The leaping insects are caught in the funnel, and a sharp tap from time to time shakes them from the slippery sides into the bottle. Also the easiest way to capture specimens on loose pieces of bark is to shake them off into the funnel. And the catch can be safely transferred from the funnel bottle to the regular collecting tube by inserting the

point of the funnel into the latter, and emptying the contents of the larger bottle into the funnel.

When he comes to use the brush, the collector soon sees that his manipulation must be varied according to the habit of the different species. The active high-strung *Isotoma* and the nervous *Tomocerus* must be "flipped" or herded into the bottle with a dry brush, while the non-leaping kinds, such as *Neanura* and *Onychiurus* and stolid genera like *Achorutes* and *Xenylla* can be picked up on a moistened brush without any trouble. Whatever others may say, the enthusiast sees no objection to moistening the brush with the lips. The absorption of an odd Collembolan that this practice may sometimes entail is entirely negative in result, as I can testify from several years' experience.

The insects are brought home alive, and are best killed, as Dr. Folsom advises, by the application of 95 per cent. alcohol heated almost to a boiling point. They may be then transferred to 80 per cent. alcohol for preservation. Springtails should never be mounted on points, as they soon shrivel up. Microscope preparations in Canada balsam, Dr. Folsom says, tend to shrink, and he suggests a mixture of glycerine jelly and acetic acid as the most satisfactory medium. An invaluable tool for "setting up" springtails and all other minute insects was discovered by Mr. J. M. Swaine, of the Entomological Branch, Ottawa, in the fine-pointed flexible wire instrument used by dentists to extract nerves, and known technically as a "broach."

As doubtless many collectors have discovered for themselves, the best work is done when one is alone. Unless your companion is equally interested with you in the particular insect you are after, his impatience and desire to move on distract, and his lack of sympathy chills you. I know people who could not watch one hour while a log was being examined with a magnifying glass, and whom even the discovery of a rare *Pseudachorutes* left quite cold.

THE BEES OF GOLD HILL, COLORADO.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Gold Hill is a small mining town in the mountains of Boulder County, Colorado, with an altitude of about 8,600 feet. It is rather well known in zoological circles because it was the residence of an indefatigable student of birds and mammals, Denis Gale. At Ward, a few miles away, Gale discovered the mouse which Merriam named *Evotomys galei*. On July 13, 1919, my wife and I spent the forenoon collecting bees at Gold Hill, on the dry hill immediately east of the town. Twenty species were obtained, listed below. The fauna is by no means entirely of the boreal type; one species, *Andrena prunorum*, extends to Southern New Mexico.

Prosopis varifrons Cresson. Females at *Rubus*.

Colletes kincaidii Ckll. Both sexes abundant at flowers of *Frasera* (*Tessaranthium*).

Sphecodes eustictus Ckll. Female at *Geranium*.

Halictus cooleyi Crawford. Common, visiting *Frasera*.

Halictus lerouxii Lepeletier. One male.

Halictus nigricollis Vachal. One male. Described by Vachal from a male

in the Vienna Museum, collected by Morrison in Colorado, and not previously recognized by me.

Halictus arapahonum Ckll. One male, this sex previously unknown. It is like *H. provancheri nearcticus* (Vach.), but the abdomen is olive green, with very distinct, faintly ochreous hair bands. Femora light ferruginous, without dark markings.

Halictus pruinosiformis Crawford. One female.

Halictus ruidosensis Ckll. One female; a rather large form with strongly dusky wings, perhaps separable.

Halictus galei, n. sp. ♀. Length about 4.5 mm.; head and thorax bluish green, not bright, somewhat shining but not polished; hair of head and thorax white, not dense; head oblong, facial quadrangle much longer than broad; front minutely excessively densely punctured all over, but this does not extend to the region between the ocelli; antennæ black, flagellum obscurely reddish beneath toward end; tegulæ dark, not punctured; wings clear hyaline, nervures and stigma testaceous; mesothorax microscopically tessellate and with distinct punctures, about the diameter of a puncture apart; area of metathorax with very irregular strong plicæ, and smaller ridges between, the apical part hardly sculptured, its surface microscopically reticulate; legs black; hind spur with three long spines; abdomen black, shining; sides of second segment (especially basally) and all of the following covered with white hair, not so dense as to entirely hide the shining surface, the little hairs beautifully plumose; hind margins of second and following segments narrowly pallid.

In my manuscript key to the subgenus *Chloralictus* this runs to *H. perdifficilis* Ckll., which it resembles in the hairy abdomen. It differs from *perdifficilis* by being very much smaller, with narrower head, and also in coloration. The narrower face, with straighter inner orbits, at once separates it from *H. ruidosensis*, but the peculiarity is not carried nearly so far as in *H. longiceps* Rob., which I have from Southern Pines, N. C. (*Manee*).

Andrena lupinorum Ckll. Common on flowers of *Rubus*, and also collected from *Potentilla*. I had only the type of this fine species.

Andrena apacheorum Ckll. One female at *Potentilla*.

Andrena prunorum Ckll. Female at *Rubus;* scape red, clypeus mainly red.

Melissodes confusiformis Ckll. One male at *Geranium*.

Epeolus hitei Ckll. One male at *Geranium;* differs from the female by having the first two antennal joints black, and the third red only in part. I had only the unique type of female.

Anthophora smithii Cress. One male.

Chelynia elegans Cress. One male at *Geranium*.

Osmia armaticeps Cress. One female at *Gaillardia*.

Megachile pugnata Say. Both sexes at *Gaillardia*.

Bombus juxtus Cress. Workers common on *Frasera*.

The *Rubus* referred to is *R. melanolasius* Focke.

Summing up the principal results; the morning's collecting gave us one new species, two previously unknown males, one species described in Europe and not before recognized by us, and several specimens of a species of which we previously had only the single type. Also, the *M. confusiformis* was the first male in good condition. In connection with Mr. Sladen's recent interesting

observations on the relation between climate and characters, it may be of interest to note that in a considerable series of *Chloralictus*, the tegulæ are dark in those species which come from the north and the mountains, light in those from the south and lowlands. Thus:

Tegulæ dark. *H. cressonii, nigroviridis, viridatus, perdifficilis, versans, ruidosensis, hortensis, planatus,* etc.

Tegulæ light. *H. semibrunneus, sparsus, floridanus, ashmeadii, versatus, zephyrus, gemmatus, bruneri, exiguus,* etc.

A LIST OF SYRPHIDÆ OF NORTHERN INDIANA.

BY M. R. SMITH, RALEIGH, N.C.

The following is a list of Syrphids collected in the vicinity of Plymouth, Indiana, during the summer of 1918. As the writer does not think he will have opportunity to collect in this region again, this short list is being published with the hope that it may be of interest to the Syrphidologist and to those interested in working up the State's fauna.

To Mr. J. M. Craig much credit is due for assistance in collecting.

The writer also wishes to acknowledge his indebtedness to Mr. C. L. Fluke for a number of the determinations.

UPLAND SPECIES.	MARSH SPECIES.
Eristalis tenax Linn.	*Helophilus similis* Macq.
E. arbustorum Linn.	*H. latifrons* Loew.
E. transversus Wied.	*H. divisus* Loew.
E. dimidiatus Wied.	*H. chrysostomus* Williston.
Sphaerophoria scripta Linn.	*H. conostomus* Williston.
S. cylindrica Say.	*H. laetus* Loew.
Paragus bicolor Fabr.	*Volucella evecta* Walker.
P. tibialis Fabr.	*Xylota fraudulosa* Loew.
P. angustifrons Loew.	*X. ejuncida* Say.
Allograpta obliqua Say.	*Tropidia quadrata* Say.
Mesogramma marginata Say.	*T. calcarata* Williston.
M. geminata Say.	*Pyrophaena rosarum* Fabr.
M. polita Say.	*P. granditarsus* Fabr.
Syrphus ribesii Linn.	*Platychirus quadratus* Say.
S. americanus Wied.	*P. hyperboreus* Staeger.
S. xanthostomus Williston.	*Melanostoma mellinum* Linn.
S. abbreviatus Zett.	*M. obscurum* Say.
Syritta pipiens Linn.	*Neoascia globosa* Walker.
Milesia virginiensis Drury.	*Chrysotoxum pubescens* Loew.
Spilomyia hamifera Loew.	*Pterallastes thoracicus* Loew.
S. longicornis Loew.	*Eristalis bastardi* Macq.
Baccha fascipennis Wied.	*E. flavipes* Walker.
Xanthogramma flavipes.	

THREE NEW CANADIAN ANTHOMYIIDÆ (DIPTERA).

BY J. R. MALLOCH, URBANA, ILL.

The three species described in this paper were submitted to me for identification, and in order to include them in synopses which are ready for the press, they are now described in full.

The generic name Aricia R.D., is preoccupied and the next available one Helina R.D., is used in this paper.

Helina fletcheri, sp. n.

Male.—Black, so densely covered with gray pruinescence as to appear opaque gray. Orbits, face and cheeks with silvery pruinescence, antennæ and palpi black. Thorax without vittæ. Abdomen with a faint dark dorso-central vitta, and a pair of small brown spots on segment 2 and another on segment 3. Legs black. Wings clear, veins pale, yellow at bases. Calyptræ and halteres pale yellow.

Eyes bare, separated by about 3 times the width across posterior ocelli; interfrontalia at its narrowest part a little wider than either orbit; each orbit with 3 or 4 strong bristles and one or two weak hairs parafacial at base of antennæ about as wide as third antennal segment, a little narrowed below; cheek not over twice as high as width of parafacial, with a series of bristles along lower margin, 2 or 3 of which, below anterior margin of eye, are upwardly curved a bristle above vibrissa; longest hairs on arista a little shorter than width of third antennal segment. Thorax without strong presutural acrostichals or prealar bristle; postsutural dorso-centrals 3; sternopleurals 3, in a nearly equilateral triangle. Abdomen cylindrical, slightly tapered behind; tergites 3 and 4 each with transverse median and apical bristles; hypopygium large but not protuberant, fifth sternite with a rather wide, deep, wedge-shaped posterior excision, a few long bristles on each lateral extension. Fore tibia with or without a median bristle, only the dorsal apical bristle strong; fore tarsus about equal in length to fore tibia; all pulvilli longer than apical tarsal segment mid femur with a complete series of long, strong bristles on postero-ventral surface, the antero-ventral surface bare; mid tibia with 1 weak antero-dorsal and 2 or 3 posterior bristles; hind femur with a series of long bristles on postero-ventral surface and another on apical half of antero-ventral; hind tibia with 2 or 3 short bristles on antero-ventral and postero-dorsal surfaces and 2 longer bristles on antero-dorsal, the apical antero-dorsal bristle long. Costal thorn small, outer cross-vein straight; veins 3 and 4 divergent apically; last section of fourth vein over twice as long as the preceding.

Length 5 mm.

Type.—Radisson, Sask., July 30, 1907, (J. Fletcher), in the Canadian National Collection.

This species has the appearance of a Coenosia. It differs from any other North American species known to me in having the eyes widely separated, the femora very strongly bristled and the postsutural bristles 3 in number.

Hylemyia pedestris, sp. n.

Male.—Black, slightly shining, densely gray pruinescent. Head black, orbits, face, and cheeks with white pruinescence; palpi largely yellowish basally. Thorax with 5 black vittæ—a narrow median, two narrow submedian, and two

broad lateral. Abdomen with a narrow black dorsal vitta, which is obsolete on apical portion of basal segment; hypopygium glossy black. Legs yellowish testaceous, coxæ, femora and tarsi largely fuscous, sometimes the femora almost entirely fuscous, or almost entirely pale. Wings slightly grayish, yellow at bases. Calyptra and halteres yellow.

Eyes separated at narrowest part of frons by a distance equal to width of anterior ocellus; parafacial at base of antenna about half as wide as third antennal joint, much narrowed below; cheek as high as width of third antennal joint, with a few long bristles along lower margin, one of which is upwardly curved, antennæ reaching nearly to mouth-margin; arista with very short pubescence. Thorax with 2 or 3 pairs of presutural acrostichal bristles and a few intermixed setulose hairs; prealar less than half as long as the bristle behind it. Abdomen short, depressed, parallel-sided; hypopygium large; fifth sternite in both specimens before me projecting downward, large, the processes slightly curved, rounded at apices, their inner halves furnished with dense, erect black hairs, a rounded elevation laterad of base of each process on each of which there are a few bristles. Fore tibia with a short, sharp apical posterior bristle; mid femur with a few bristles near base on postero-ventral surface; mid tibia with 1 postero-dorsal and 2 posterior bristles; hind femur with antero-ventral bristles long and widely separated, the postero-ventral surface with a rather closely placed series of short bristles on basal three-fifths; hind tibia with 1 antero-ventral, 2 antero-dorsal, and 2 postero-dorsal bristles; mid and hind tarsi shorter than their tibiæ. Costal thorn small, outer cross-vein slightly curved, veins 3 and 4 subparallel apically, the former terminating almost in the apex of the wing which is slightly pointed.

Length 5.5 mm.

Type and paratype, Godbout, Quebec, Canada, July 25, 1918, (E. M. Walker). Named in honour of the collector.

The series of short bristles on basal two-fifths of hind femora and the fringes on processes of fifth abdominal sternite distinguish this species from any known to me.

Type in the Royal Ontario Museum of Zoology, Toronto.

Hylemyia quintilis, sp. n.

Female.—Black, shining, rather densely gray pruinescent. Head entirely black, the orbits and parafacials with white tomentum, the remainder of head with less dense pruinescence. Thorax with 5 poorly defined brown dorsal vittæ. Abdomen more distinctly shining than thorax, with a large patch of gray pruinescence on each side of each tergite posteriorly. Legs black. Wings with a yellowish brown tinge, veins dark brown, yellow basally. Calyptræ white. Halteres yellow.

Frons over one-third of the head-width, a little widened anteriorly, orbits well defined, each about one-fourth as wide as interfrontalia at anterior extremity of ocellar triangle, and with 3 bristles in front of lower supraorbital bristle, otherwise bare, interfrontalia with a pair of strong curciate bristles, and a few microscopic hairs on each side, ocellar triangle with 2 long bristles and several long setulæ, parafacial at base of antennæ wider than height of cheek and a little wider than third antennal joint, narrowed below, the vibrissal angle much produced, anterior upper margin of mouth forming a sharp ridge which

projects well beyond the line of anterior margin of frons; lower margin of cheek with a few strong bristles in a single series and some short weak hairs, the series of strong bristles widely interrupted below parafacial; third antennal joint broad, about twice as long as second, arista almost bare, second joint longer than thick, third swollen at base. Presutural acrostichals 2-rowed, one pair strong, prealar bristle long; sternopleurals 2:2, the lower anterior one weak. Abdominal tergites with strong bristles on posterior margins; sternites 3 to 5 each with strong bristles on lateral margins, basal sternite bare. genitalia with two slender processes at apex. Fore tibia with a strong median posterior bristle, basal joint of fore tarsus nearly as long as the other four combined, third, fourth, and fifth joints broadened, third twice as long as fourth, the latter one-third as long as fifth, which is about three times as long as broad, mid legs lacking, hind femur with about 8 bristles on apical three-fifths of antero-ventral surface, and 1 bristle near base on postero-ventral; hind tibia with 3 short antero-ventral, 3 moderately long and 4 short antero-dorsal, and 3 long and 5 or 6 short postero-dorsal bristles. Costal thorn short; veins 3 and 4 subparallel apically, last section of the latter not much longer than the preceding section.

Length 7 mm.

Type.—Godbout, Quebec, Canada, July 25, 1918, (E. M. Walker).

This species resembles the female of *latipennis* Zetterstedt, in having the apical fore tarsal joint dilated, but *latipennis* has the fourth joint much longer, distinctly longer than wide, the hind femur with 2 or 3 bristles on apical fourth of antero-ventral surface, and the hind tibia with 3 long bristles on the postero-dorsal surface, the short bristles being absent.

Type in the Royal Ontario Museum of Zoology, Toronto.

NOTES ON PLATYDEMA ELLIPTICUM FAB., AND ITS FUNGUS HOST.

BY HARRY B. WEISS, NEW BRUNSWICK, N.J.

During the middle of September, larvæ and pupæ of this species were quite abundant in the fungus *Polyporus gilvus* at Union, N.J. Many of the larvæ were full grown at this time, and adults had just started to emerge. Larval burrows were found throughout the fungus, but most of the pupal cells were located in the base of the fungus close to the bark of the tree. *Polyporus gilvus* is a woody fungus which is extremely common in Eastern Canada and Northern United States, occurring on dead deciduous wood.

Full grown larva.—Length 12 mm. Greatest width 1.7 mm. Elongate, subcylindrical, somewhat hard, whitish or with dark contents of alimentary tract showing. Head and anterior portion of first thoracic segment dark, reddish brown. Faint to dark transverse chitinized areas on dorsal surface of each segment. Head with a fine, white, U-shaped line which connects with a fine, median, dorsal line extending to first abdominal segment. Head bears a few punctures within the U-shaped line and many without. Head and body sparsely hairy. Legs bearing several spine-like hairs. Last abdominal segment bearing a row of five minute spines on its posterior edge, the middle spine being the largest.

Pupa.—Length 7 mm. Width across wing-cases 3 mm. Whitish, suboval, rounded anteriorly, gradually tapering posteriorly. Head, thorax and ventral surface sparsely hairy. Dorsal surface bears a number of fine, minute hairs. Hairs on anterior and lateral thoracic margins long and fine. Lateral body hairs longest. Sides of abdominal segments two to five produced into somewhat flat, plate-like, subrectangular, expanded tubercles. Anterior and posterior transverse edges of each expansion or tubercle chitinized and serratulate, the distal corner ending in a minute spine. Lateral edge of expansion bears a minute, median spine with a long hair arising from below the tip. The lateral expansion on the first abdominal segment has a heavily chitinized posterior edge, a minute, median, lateral spine but the anterior edge is not chitinized nor serratulate. Lateral expansion on sixth abdominal segment is smaller than the others and lacks the posterior edge. Last abdominal segment terminated at each edge by a comparatively prominent, pointed spine.

Adult.—*Platydema ellipticum*. This was described by Fabricius in 1801 (Syst. Eleut., II, 1801, 566). The beetle is elongate-oval, about 6 mm. long, black, each elytron having an oblique irregular reddish spot extending from the humerus to the suture. The thorax is finely and sparsely punctate, the elytra finely striate and the striæ with fine, distant punctures. It is generally distributed throughout New Jersey and occurs according to Smith (Insects of N.J., N.J. St. Mus. Rept. 1909) under the bark of fungus-covered trees. Blatchley (Coleoptera of Indiana) states that it is frequent in the southern half of Indiana beneath bark on fungus covered logs. Up to the present time this species has been found associated only with *Polyporus gilvus* in New Jersey, but it is extremely probable that it breeds in other woody fungi also.

A NEW ANTHOMYIID FROM LABRADOR (DIPTERA).

BY J. R. MALLOCH, URBANA, ILL.

The species described herein I have placed in the genus *Helina* Robineau Desvoidy (*Aricia* auct.) with some hesitation. The genus is, however, decidedly composite and pending a satisfactory subdivision of it the present arrangement is the best available. Stein in all his more recent papers on Anthomyiidæ uses the name *Mydæa* for this genus, but that name is, as I have pointed out in several of my papers, properly applicable to the small group of which *pagana* Fabricius is the type.

Helina tuberculata, sp. n.

Male.—Black, shining, with conspicuous gray pruinescence. Head entirely black. Thorax with 4 broad, black vittæ. Abdomen with a pair of large, ill-defined, subtriangular black spots on second and another on third segment. Legs black. Wings slightly brownish, more distinctly so along the courses of veins, yellowish basally. Calyptræ and halteres orange yellow.

Eyes distinctly hairy, separated by about width across posterior ocelli; parafacial at base of antenna at least as wide as third antennal joint at apex, not narrowed below; third antennal joint broadened apically, second with several long bristles above; arista short pubescent. Thorax with or without a pair of long presutural acrostichals; prealar bristle at least half as long as the bristle behind it; postsutural dorso-centrals 4; hypopleura bare; sternopleurals 1:2; scutellum bare below and on sides. Abdomen ovate; first sternite bare;

fifth sternite with a broad shallow posterior emargination, a number of long bristles on each side at base of emargination, the lateral projections bare. Fore tibia without median bristle; mid femur gradually thickened to beyond middle, then rather abruptly attenuated to apex, a group of strong bristles at apex of swollen part on antero-ventral surface, and two or three bristles near base on postero-ventral surface; mid tibia slightly distorted, with about a dozen strong bristles on basal half of posterior surface, a small tubercle one-third from apex on same surface, and dense, short bristles on ventral surface from base to and covering the tubercle; hind femur slightly curved, slender basally, with a number of long bristles on apical half of antero-ventral surface; hind tibia very slightly curved, antero-ventral surface with about 9 short bristles, antero-dorsal surface with five or six short bristles, the posterior surface with about eleven long bristles on apical three-fifths. Third and fourth veins much divergent apically. Lower calyptra about twice as large as upper.

Length 9 mm.

Type.—Rigolet, Labrador, July 18, 1906.

This species has the hind tibia armed almost as in *pectinata* Johannsen, but the peculiar mid tibia separates the species from it and all other species known to me from this country or Europe.

This specimen was sent to me by Mr. C. W. Johnson, and pending its final disposition the type is in the collection of Illinois Natural History Survey.

A PLEA FOR MORE ACCURATE TAXONOMY IN MORPHOLOGICAL AND OTHER STUDIES.

BY MORGAN HEBARD, CHESTNUT HILL, PA.

It has been noted by the author that morphologists and students interested in specialized studies of certain species are often inclined to give imperfectly or inaccurately the necessary taxonomy for the material treated.

This is understood only when we realize that the subject treated is of great interest in such papers, the proper name for the material studied often of little or no interest to the morphologist.

That the correct name is of very great importance it would seem must be admitted by all, when it is pointed out that from different species, though sometimes apparently very closely related, different results are often obtained, even from morphological studies.

It is true that the systematic work of the past has often left much to be desired, and many changes have been necessitated thereby. That, however, should not warrant slurring systematics any more than that equally unsatisfactory past work of morphologists and reversal of conclusions should cause interest in morphology to wane. The advance of all science is built in part upon the correction of past errors.

Another excuse for lack of proper taxonomic assignment is that it is often difficult to secure the required names from a systematist. This is indeed sometimes true, but, in the great majority of cases, one fiftieth the time and effort expended in preparing the material in question for study, would have secured the necessary determinations.

As a concrete instance, we would note Mr. E. Melville Du Porte's recent article, "The Propleura and the Pronotal Sulci of the Orthoptera."(1)

(1) Can. Ent., LI, pp. 147 to 153 (1919).

This excellent paper treats, in a masterly way, a most interesting subject. It is marred solely by inaccurate or incomplete taxonomy. The taxonomic faults may be summarized as follows:

Acridiidæ = *Acrididæ*.

Rhomalea = *Romalea*.

Tettigidæ = *Acrydiinæ*.

Tettix granulatus = *Acrydium granulatum*.

The references in this paper to *Acrydium* are correctly referable to that genus, of which *granulatum* is a member.

Locustidæ = *Tettigoniidæ*.

Conocephalus = *Neoconocephalus*, a genus including but few North American species. It has been recently revised and the specific determination would, in consequence, have been easily made'

Xiphidium = *Conocephalus*.

Microcentrum. As there are but two, widely distributed, North American species of this genus, *laurifolium* and *retinerve*, the specific assignment could have been readily made.

Gryllus pennsylvanicus = *Gryllus assimilis*.

The taxonomy in this paper could have been corrected by a systematist in a few minutes. Would it not be desirable to have all such papers correct throughout, rather than satisfactory as far as the subject being studied is concerned, but full of inexcusable taxonomic flaws?

NOTE ON MR. HEBARD'S ARTICLE.

The Editor, having given some attention to the taxonomy of the Orthoptera, was aware that the nomenclature followed in Mr. Du Porte's paper was not up to-date, but considered it inadvisable to alter it, since the names employed have long been in common use, and are more or less familiar to the general student, for whom the paper is intended. The nomenclature of Orthoptera has undergone numerous changes in late years, and some of these changes, though doubtless necessary, if the law of priority is to be followed, are of a most unfortunate character. Many old familiar generic terms have been abandoned, or what is more confusing, transferred to other forms. For example, the little "grouse-locusts," generally known as *Tettix* are now *Acrydium*, while the large locusts formerly called *Acridium* are now *Locusta*, a name which used to be employed for insects of another family. Again, the name *Conocephalus*, so long and appropriately given to the large "cone-headed grass hoppers" must now be shifted to the little meadow grasshoppers familiar to all as *Xiphidium*, the cone-heads becoming *Neoconocephalus*. Such changes as these are, of course, very confusing to all but the specialist. Were they really permanent, it would indeed be desirable to promote their use as rapidly as possible, but what guarantee have we that they will remain more than a few years? They are not even universally accepted by specialists.

Is there such a thing as "correct taxonomy?" We think, at least, that systematists are inclined to over-estimate its importance; and while we agree with Mr. Hebard's contention that morphologists are too apt to be careless in regard to taxonomic matters, we think that the converse is equally true, that the systematist is usually very inaccurate in the use of morphological terms, and indifferent as to the morphological significance of the structures he describes.

RECENT CANADIAN PUBLICATIONS.

(Continued from page 263.)

THE APPLE MAGGOT.—By L. Caesar, B.A., B.S.A., Provincial Entomologist, and W. A. Ross, B.S.A., Entomological Branch, Dominion Department of Agriculture. Bull. 271, Fruit Branch, Ont. Dept. of Agriculture. Pp. 1–32, with 17 figures in text.

The investigation upon which this excellent bulletin is based was commenced in 1911, when the apple maggot was abundant in many parts of Ontario, and has been continued during each succeeding year. It contains a detailed account of the life-history of this insect, with full data on its seasonal history, habits, distribution, influence of environmental factors and methods of control.

Although normally the life cycle is completed within a year, a certain number of pupæ remain in the soil during a second winter, the flies emerging the following summer. There is also in the warmer parts of Ontario a partial second brood in some seasons, though a very insignificant one. The time of emergence of the flies, which begins as a rule about the first week in July, and continues throughout most of August, is not influenced by the time of pupation, i. e., flies from pupæ from early varieties of apples do not appear to emerge any sooner than those from later varieties.

Natural control seems to depend mainly upon weather factors, parasites being apparently of very minor importance. Hardening of the soil surface, as a result of heavy rains followed by drought, may either prevent the flies from emerging or the larvæ from pupating beneath it, and large numbers may perish in these ways.

Much variation exists in the susceptibility of different varieties of apples and crabs to infestation.

The most effective control measures are found to consist in spraying with arsenicals, the mixture recommended being arsenate of lead paste, 2½ lbs. to 40 gallons of water, without any molasses or other sweetening. "The first application should be given as soon as the flies begin to emerge, so that they may be killed before they can lay eggs," the proper date of application in an average season varying according to the district, from June 25, in the warmest parts of the province, to July 7 in the more northerly localities. A second application should be made as soon as the first shows signs of disappearing, and a third may be necessary if heavy rains should wash off the second, and is recommended in all cases the first year after a bad infestation.

Good figures from original photographs are given to illustrate the different stages of the insect and its work on the apple.

REPORT OF THE PROVINCIAL MUSEUM OF NATURAL HISTORY FOR THE YEAR 1918, PROVINCE OF BRITISH COLUMBIA.—Victoria, 1919. Pp. T 1–16, with 2 plates. Entomology. By E. H. Blackmore.

Mr. Blackmore's article constitutes the greater part of the report (pp. 6–13), and consists chiefly of notes on the occurrence of uncommon insects taken in British Columbia during the season of 1918. These include 12 species, belonging to several orders, that were described as new during the year, and a

considerable number of Lepidoptera, 20 species of which are illustrated on the two plates by excellent half-tones from photographs.

Four species of this order are reported as having been present in the province in destructive numbers, viz., the forest tent-caterpillar (*Malacosoma pluvialis*), the tortoise-shell butterfly (*Aglais californica*), the alfalfa looper (*Autographa californica*) and a tussock moth (*Hemerocampa vetusta gulosa*), which was devastating Douglas Fir at Chase, B.C.

Report of the Canadian Arctic Expedition, 1913–18.—Vol. III—Insects. Southern Party 1913–16. Ottawa, 1919.

Six parts of this volume have thus far been issued. Most of the collections in all the orders were made by Mr. Frits Johansen, and a large part of the material was collected at Bernard Harbour, Dolphin and Union Straits, Northwest Territories, and at Nome and other localities on the Arctic coast of Alaska.

Part A, Collembola. By Justus W. Folsom. Pp. 1–29, including 8 plates with 72 figures. This is a very full report on the 12 species and varieties of springtails taken by Mr. Johansen. All the species are described and the characters well illustrated. An extensive bibliography is also given. The species are distributed among the following genera: Podura (1); Achorutes (2, 1 n. sp.); Onychiurus (1 n. sp.); Tetracanthella (1); Isotoma (2 sp.); Entomobrya (1); Lepidocyrtus (1); Sminthurides (1).

Part B, Neuropteroid Insects, by Nathan Banks. Pp. 1–5 with 1 plate. Only two orders are represented in the collection, the Plecoptera and the Trichoptera, three species of the former and four of the latter having been taken. One species of each order is described as new, a Capnia and an Anabolia, but other new forms may be present as the specimens are not all specifically determinable.

Part C. Diptera. Craneflies; by C. P. Alexander. Mosquitoes; by H. G. Dyar; Diptera (excluding Tipulidæ and Culicidæ); by J. R. Malloch. Pp. 1–90, with 10 plates.

Craneflies. The collection is relatively rich in these forms, there being at least 16 species represented, including one Rhyphid (a Trichocera, represented by larvæ only) and 15 Tipulidæ. Five of these belong to the Limnobiinæ, embracing 4 genera, and 10 to the Tipulinæ, representing 3 genera. The largest genus is Tipula with 7 species. With but two exceptions the craneflies of this collection all belong to new species.

All the species, including larval forms, are fully described and figured.

Mosquitoes. Only two species are represented among the 134 specimens in the collection, both belonging to Aedes (Ochlerotatus). One of these, taken in large series and also reared is described as new, *A. nearcticus*. The other species is represented only by females and was left unnamed.

Diptera (exclusive of Tipulidæ and Culicidæ); pp. 34–90, pls. VII–X. These belong to 18 families in which they are distributed as follows: Sciaridæ, 3 sp.; Chironomidæ, 16 sp. (with a new species each in Tanypus and Diamesa); Simuliidæ, 6 sp. (1 n. sp. each in Prosimulium and Simulium); Leptidæ, 1 sp.;

Empididæ, 7 sp. (all Rhamphomyia, 5 new); Dolichopodidæ, 6 sp. (1 n. sp. each in Dolichopus and Hydrophorus); Phoridæ, 3 sp. (all Apiochæta, 2 n. sp.); Borboridæ, 1 sp., a new Leptocera; Syrphidæ, 8 sp.; Oestridæ, 2 sp.; Tachinidæ, 2 sp. (1 new Peleteria); Calliphoridæ, 4 sp. (1 new Phormia); Anthomyiidæ, 26 sp. (n. sp. in Phaonia, 1 Mydæina n. gen., 1 Aricia, 1 Hydrophoria, 1 Alliopsis, 1 Hylemyia and 1 Phorbia); Scatophagidæ, 8 sp. (1 n. sp. each in Gonatherus and Cordylurella, n. gen., Dasypleuron n. gen., and Allomyia n. gen.; Helomyzidæ, 3 sp. (1 n. sp. each in Oecothea and Neoleria); Piophilidæ, 1 sp. (a new Piophila) and Chloropidæ, 1 sp.

Much of the material in the collection was specifically indeterminable, so that it is probable that it contains a considerable number of undescribed species.

This paper also contains keys to the genera of Phaoninæ and Anthomyiinæ, and to those of the entire family of Scatophagidæ and Helomyzidæ.

Part D, Mallophaga and Anoplura. Mallophaga; by A. W. Baker; Anoplura, by G. F. Ferris and G. H. F. Nuttall. Twenty species of Mallophaga are listed from 13 bird hosts and one mammal. All belong to described species with the possible exception of three species which were too immature for specific determination. Four of the species are illustrated on the plate. Only three species of true lice or Anoplura were taken, one of these being the human head louse, collected from the head hairs of copper Eskimos.

Part F, Hemiptera, by E. P. Van Duzee. Pp. 1–5. The scarcity of Hemiptera in the Arctic regions is indicated by the small size of the collection, which consists of but 12 species. Only 6 of these were specifically determinable, one species being described as new, viz., *Euscelis hyperboreus*, n. sp.

Part H, Spiders, Mites and Myriopods. Spiders, by J. H. Emerton. Acarina, by Nathan Banks. Chilopoda, by Ralph V. Chamberlin.

Spiders (pp. 1–9, pls. I–III). The collection of spiders include 13 species of which three are described as new. They are distributed among the following genera: Erigone (1), Typhlocræstus (1), Tmetocerus (2, 1 n. sp.), Microveta (2, 1 n. sp.), Epeira (1), Dictyna (1), Lycosa (2, 1 n. sp.), Pardosa (2), and Xysticus (1).

Descriptive and distributional notes are given on many of the species and structural details of most of the forms are figured.

Acarina, (pp. 11–13). The mites belong to 7 families, 14 genera and 17 species, only one of which is described as new. (*Stigmæus arcticus*, figs. 1 and 2). They belong to the genera Rhagidia (1), Bdella (3), Bryobia (1), Stigmæus (1), Trombidium (1), Evlais (1), Hydrophantes (1), Thyas (1), Lebertia (1), Laminipes (1), Curvipes (1), Parasitus (1), Galumna (1), and Scutovertex (2).

Chilopoda (pp. 15–22, pl. IV). Two species of Chilopods, one belonging to the Lithobiomorpha, the other to the Geophilomorpha, are the only Myriopods collected by the Expedition, and both were taken in the Cape Nome region, Alaska. Mr. Chamberlin, however, gives a list of all the Alaskan Chilopods (14 species), a key to the genera of the family Chilenophilidæ, and a full description of *Cryophilus alaskanus*. n. gen. et sp. *Ethophilus integer*, n. sp., though not represented in the collection of the Expedition is also described, a subspecies (*alaskanus*) having been reported from Alaska. The typical form comes from Washington and Oregon. E.M.W.

(To be continued).

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